



May 29, 2020

Michigan Department of Transportation Aeronautics
2700 Port Lansing Road
Lansing, MI 48906

Re: Municipal Airport PFAS Funding Grant
TVC Airport Application

Dear Steve Houtteman:

On behalf of the Northwestern Regional Airport Commission, I am submitting to you the enclosed grant application for municipal airport per- and poly-fluoroalkyl substance (PFAS) funding for Cherry Capital Airport (TVC). As a Part 139 airport, Cherry Capital Airport stores, tests, and, if necessary, utilizes aqueous film forming foam (AFFF) as required by FAA regulation. AFFF is a known source of PFAS chemicals; however, we have not tested environmental media for potential effects from AFFF.

We are requesting \$249,981 in grant funds to implement an assessment program for five areas of suspected PFAS impact. Environmental media of interest include soil, groundwater, and stormwater. The groundwater pathway is the most relevant as private water supply wells and Lake Michigan exist downgradient of the airport. The proposed activities and budget include contingency activities downgradient of airport property that will aid in exposure pathway evaluation if PFAS is present in the groundwater, including potential sampling of private water supply wells. The proposed work will be completed by environmental professionals in accordance with Michigan Department of Environment, Great Lakes, and Energy (EGLE) PFAS sampling guidance.

We appreciate MDOT Aeronautics and EGLE making this grant available. Should you have any questions regarding our application, or would like supplemental information, please feel free to contact me.

Sincerely,

Kevin Klein, A.A.E.
Airport Director

Enclosure: Municipal Airport PFAS Grant Application, May 29 2020

Municipal Airport PFAS Grant Application

Cherry Capital Airport - NRAC
Traverse City, Michigan

May 29, 2020

Applicant:

Cherry Capital Airport
727 Fly Don't Drive
Traverse City, Michigan
(231) 947-2250
www.tvcairport.com

Prepared by:

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1.0 APPLICANT INFORMATION

1.1 Introduction

Cherry Capital Airport (TVC) opened in 1935 and airline service began in 1938. The airport is categorized as a primary commercial service airport in the National Plan of Integrated Airport Systems (NPIAS). In 2019, TVC had 579,712 total passengers and 97,924 total aircraft operations. Airline service at TVC is provided by Allegiant, American, Delta, and United Airlines. TVC is owned by Grand Traverse and Leelanau Counties and operated by the Northwestern Regional Airport Commission. TVC complies with Federal Aviation Regulation Part 139 and is an Index B airport.

Historically, the Airport was owned by the City of Traverse City, however it was transferred to the United States Navy, Department of Defense during World War II and later transferred back to the City of Traverse City. The City owned and operated the airport until 1971. In 1971 the City formed the Northwestern Regional Airport Commission with Grand Traverse and Leelanau Counties to operate the airport. In 1990, the City left the Commission and transferred the property to Grand Traverse and Leelanau Counties. Operation remained with the Northwestern Regional Airport Commission.

1.2 Applicant Contact

Project Name: Northwestern Regional Airport Commission/TVC PFAS Assessment
Project Location (County): Grand Traverse
Grant Amount Requested: \$249,981.00
Contact for the Airport: Kevin C. Klein, A.A.E - Airport Director
Contact Phone Number: (231) 947-2250
Contact Email: kevin.klein@tvcairport.com

2.0 PROJECT DESCRIPTION

The goal of this project is to evaluate possible soil, storm water, and groundwater impacts at five potential PFAS source areas. Data gathered as part of this effort will be used to complete a preliminary assessment of potential risks to receptors, which may include private groundwater supply wells and surface water bodies. Soil and groundwater at TVC have not previously been tested for PFAS; however, operational knowledge has identified areas where PFAS-containing AFFF has been stored, used, and/or discharged. This knowledge will be used to guide the initial investigation. Soil sampling will aid in

confirming source areas and evaluating risk related to groundwater/surface water protection and due care. Groundwater sampling, using existing monitoring wells and new monitoring wells installed under this grant application, will be used to determine the potential for offsite migration and to evaluate risks related to groundwater use.

3.0 ELIGIBILITY REQUIREMENTS

TVC meets all the eligibility requirements stipulated in the grant request for proposals. Information supporting this determination of eligibility is provided in Attachment 1.

- TVC is a current Part 139 commercial service airport as defined in Title 14 of the Code of Federal Regulations. TVC is not a joint use airport with the US military.
- TVC is in good standing with EGLE and MDOT grant programs and has not had a grant revoked, terminated, nor demonstrated inability to meet grant obligations
- TVC does not appear on the Federal Debarment and Suspension List
- TVC, and contractors, can certify that they are not an Iran-based nor Iran-linked business
- If selected, TVC will be able to sign a grant agreement with MDOT by September 15, 2020
- If requested, a certified audit prepared within the past 24 months be provided

The airport commission has discussed this grant opportunity and supports staff pursuing its award. Immediate action will be taken by the airport commission upon notification from MDOT of a grant award.

4.0 ENVIRONMENTAL BACKGROUND

4.1 Current and Suspected Historic PFAS Uses

As required by FAA rules, TVC has Class B firefighting foams available for use in the event of a fire. Accordingly, TVC has stored, tested, and utilized these foams, which are commonly referred to as aqueous film forming foam (AFFF). Review of safety data sheets (formerly, material safety data sheets) indicates that these firefighting foams contain polyfluoroalkyl substances. Copies of these safety data sheets are provided in Attachment 2.

Historical knowledge of airport operations has identified five areas of interest as potential PFAS source areas. These areas, identified on the aerial image provided as Figure 1 in Attachment 2, are summarized in Table 1.

TABLE 1 AREAS OF INTEREST

LOCATION DESCRIPTION		CAUSE FOR INTEREST
1	NE End of Runway 18	Historic testing location for firefighting equipment; Known foam discharge area.
2	Maintenance Hangar	Aircraft maintenance area, Hydraulic fluid use and storage area; Potential discharge area.
3	Former Fire Department & Maintenance Area	Previous storage and testing location for AFFF and firefighting equipment; Known foam discharge area.
4	Current Fire Department	Current storage and testing location for AFFF and firefighting equipment; Known foam discharge area.
5	South End of Runway 36	Historic disposal site; Potential discharge area.

4.2 Conceptual Site Model

Cherry Capital Airport is located within the City of Traverse City in portions of Sections 12, 13, and 14 of Township 27N, Range 11W (T27N-R11W) and Sections 17 and 18 of T27N-R10W. The surrounding properties support multiple uses, including residential, commercial, industrial, educational, and the United States Government.

Soils in the area consist primarily of lacustrine sand and gravel as reported by the Quarternary Geology of Southern Michigan map¹ and as observed in soil borings completed to support geotechnical and environmental investigations at the airport. Groundwater is encountered 10-feet to 15-feet below ground surface. As shown in Figure 2 of Attachment 2, groundwater near the former leaking underground storage tank site, which is located nearest the former fire department area of interest (Area #3), has an

¹ Farrand, W.R., and Bell, D.L. Michigan Department of Natural Resources. (1982) *Quarternary Geology of Southern Michigan*. 1:500,000 scale. Geologic Publication QG-01.

east-northeastern flow direction. Extrapolating this to the surrounding area, groundwater flow from the airport is believed to be northeast towards East Grand Traverse Bay of Lake Michigan, which is between 0.6-miles and 1.0-miles northeast of the airport. A small surface water feature, Mitchel Creek, crosses the east side of airport property and may also receive venting groundwater. There are no known direct stormwater discharges from the airport property to any surface water body.

According to EGLE's online map GeoWebFace² (see Figure 3 of Attachment 2), numerous private water supplies are documented between the airport and Lake Michigan. It is not known to the applicant at this time if these wells still exist, nor if they are used as drinking water sources. The City of Traverse City and East Bay Township have municipal drinking water systems that provide service in the area. The City of Traverse City uses East Grand Traverse Bay as a drinking water intake source for their municipal water system. The 2018 EGLE-funded Statewide PFAS sampling program for municipal water supplies included the City of Traverse City's water treatment system. The study did not report detections of PFAS above analytical detection limits in the City's water treatment system³.

Area 1, at the north end of runway 18, consists of a small earthen basin. This area was historically used to test firefighting equipment as required by FAA rule by spraying AFFF and discharging it onto the ground. Given the relatively shallow depth to groundwater and the soil types, it is believed that surface releases of PFAS-containing AFFF could result in PFAS impacted groundwater. There is also a likelihood that surface soils in this area are impacted with PFAS.

Area 2, the maintenance hangar along Airport Access Drive, is not a known release location of PFAS-containing chemicals. This hangar is used for aircraft maintenance and, as such, is a potential release location for aviation hydraulic fluid. No reportable releases of PFAS-containing hydraulic oil have occurred; however, it is an area of concern.

Area 3, the former fire department and maintenance building, is known to be a former storage and testing area for AFFF. This area also coincides with a Part 213 leaking underground storage tank site

² <http://www.deq.state.mi.us/geowebface/>

³ 2018 PFAS Sampling of Drinking Water Supplies in Michigan, Prepared by AECOM for the Michigan Department of Environment, Great Lake, and Energy. July 26, 2019.

that historically utilized low volume air sparging to address petroleum contamination. Oxidation technologies, such as air sparging, are suspected of transforming fluorinated precursors into PFAS. Given the relatively shallow depth to groundwater and the soil types, it is believed that surface releases of PFAS-containing AFFF could result in PFAS impacted groundwater.

Area 4 is the current fire station serving the airport. AFFF is currently stored and tested at this location. AFFF equipment testing is now completed with self-contained E-ONE ECOLOGIC test equipment, which was obtained through a previous grant program with MDOT. TVC began using this test equipment in September 2019. A release of AFFF occurred in March 2020 and was promptly reported to EGLE RRD. As a result of the March 2020 release, as well as operations prior to implementation of the current testing procedures, there is potential for PFAS impact to the soils, retention pond, and groundwater.

Area 5, located at the south end of runway 36, is a historic disposal site. It was used during World War II and into the 1970's by the City of Traverse City for wastewater treatment sludge disposal. There are no known impacts from PFAS-containing chemicals in Area 5; however, due to historic uses, it remains an area of interest.

4.3 Environmental Benefit of Project

The combination of historic and current uses of PFAS-containing AFFF, the hydrogeologic conditions of the area, and potential receptors downgradient of the Cherry Capital Airport support the need for PFAS assessment. The potential for environmental impact is high. The proposed assessment work will provide a solid foundation for assessing potential impacts that may be the result of operations at Cherry Capital Airport.

5.0 PROPOSED INVESTIGATION ACTIVITIES

5.1 Area Summary

The unique conditions at each area of interest result in slightly different evaluation approaches. In each instance, however, groundwater is the primary media of concern due to the potential for offsite migration. The intent of this work plan is to provide a solid basis for making future decisions regarding potential risks related to PFAS impact at TVC. Additional efforts will likely be necessary to fully

characterize the site. The soil, groundwater, and storm water evaluation proposed for each area are described below and summarized in Table 2. The generalized locations of the proposed samples are shown in Figure 1 of Attachment 3. More detailed information on sampling and monitoring well construction methods are described later in this section and in the QAPP.

5.1.1 Area 1

Installation of four monitoring wells is proposed for Area 1: one upgradient, one in the assumed source area, and two downgradient. The collection of three soil samples is proposed from within the historical discharge area. The locations of the monitoring wells and soil borings will be determined by field personnel based on input from airport personnel and field observations. Collection of storm water or surface water samples are not anticipated from this area.

5.1.2 Area 2

Installation of three monitoring wells is proposed downgradient of the maintenance building in Area 2. The wells will likely be installed in the greenspace along Airport Access Drive, northeast of the building. Collection of soil samples is not anticipated as there are no known surface releases of PFAS-containing compounds in this area. Collection of storm water or surface water samples are not anticipated from this area.

5.1.3 Area 3

Numerous monitoring wells, which were installed as part of the LUST project, exist at the north edge of Area 3. Two of these wells, one upgradient and one downgradient, will be selected as PFAS monitoring points. Two additional groundwater monitoring points will be installed further south and east to assess potential impact more adequately. Collection of three soil samples from areas likely to have received runoff is proposed.

5.1.4 Area 4

Surface water sampling near the inlets and on the north side of the retention basin is proposed. Soil samples will be collected from the earthen ditch that directs storm water to the basin. If surface water is not present at the time of sampling, soil samples will be collected from within the basin. The retention

basin does not have a piped outlet and accumulated water infiltrates into the subsurface. Three monitoring wells are proposed downgradient of the basin to assess groundwater impacts in this area.

5.1.5 Area 5

Installation of three monitoring wells downgradient and one monitoring well upgradient of Area 5 is proposed. The wells will likely be installed along the perimeter drives to maintain clear area near the runway. Collection of soil samples is not anticipated as there are no known surface releases of PFAS-containing compounds in this area. Collection of storm water or surface water samples is also not anticipated from this area.

TABLE 2 AREA ASSESSMENT SUMMARY

AREA	SOIL SAMPLES	GROUNDWATER MONITORING	STORM WATER SAMPLING
1	3 within basin	Install 2 monitoring wells downgradient, 1 in source area, and 1 upgradient. Quarterly sampling.	Not anticipated
2	Not anticipated	Install 3 monitoring wells downgradient. Quarterly sampling.	Not anticipated
3	3 in potential drainage areas	Install 1 monitoring wells downgradient and 1 south of former building. Quarterly sampling to include 2 existing monitoring wells.	Not anticipated
4	3 within stormwater ditch	Install 3 monitoring wells downgradient. Quarterly sampling.	One-time event at 3 locations within basin
5	Not anticipated	Install 3 monitoring wells downgradient and 1 monitoring well upgradient. Quarterly sampling.	Not anticipated

5.2 Quality Assurance Project Plan

Environmental assessment work for PFAS impacts will be completed in accordance with MPART guidance documents. A brief, 1-page, Quality Assurance Project Plan (QAPP) is included in Attachment 4.

5.3 Groundwater Assessment Methods

5.3.1 Monitoring Well Installation

Monitoring wells will be installed using a CME 55LC track-mounted drill rig advancing 4.25-inch I.D. hollow stem augers. Soil samples, to document the soil lithology, will be collected by performing standard penetration tests (SPT) utilizing a stainless-steel split spoon sampler. The soil samples will be collected continuously from ground surface to total depth (5-ft below groundwater table) at one monitoring well location and at five-foot intervals at the remaining monitoring wells in each of the areas of interest. Total depth of the wells will be approximately 5-ft below the groundwater table identified during drilling activities. Prior to drilling at each monitoring well location, all tooling will be decontaminated by steam-cleaning.

The monitoring wells will be constructed of 2-inch diameter schedule 40 flush joint PVC casing and a 2-inch schedule 40 flush joint PVC, 0.010-inch milled slot, 5-foot long screen. Filter pack sand will be placed in the annular space from the bottom of the screen to 2-ft above the top of the screen. The remaining annular space will be filled with bentonite to within approximately 3-ft of ground surface followed by native soil cuttings. A stick-up or flush mount (depending on location of monitoring well and requirements of the airport) protective cover will be concreted in place around the capped and locked monitoring well. Soil cuttings will be containerized for characterization and disposal.

Each monitoring well will be developed by over-pumping and surging until water is clear and a minimum three well volumes have been removed. The development water will also be containerized for characterization and disposal.

Groundwater monitoring well locations will be surveyed horizontally and vertically. Ground elevations will be surveyed to within 0.1-foot and top of casing elevations will be surveyed to within 0.01-foot. Elevations will be referenced to the National Geodetic Vertical Datum of 1988.

5.3.2 Groundwater Sampling

All groundwater monitoring wells will be sampled via minimal drawdown (low-flow) sampling methodology on a quarterly basis in accordance with the QAPP. Only fluoropolymer-free (PFAS-free) monitoring equipment will be used in contact with groundwater. Sampling equipment includes a water

level probe, peristaltic pump, tubing, and a multiparameter meter with flow cell. Equipment blanks will be collected daily during groundwater sampling activities.

Sampling personnel will monitor the static water level and adjust the pumping rate to minimize drawdown in the well. Temperature, potential hydrogen (pH), conductivity, dissolved oxygen (DO), oxidation/ reduction potential (ORP), and turbidity will be monitored. When parameters reach stabilization criteria, groundwater samples will be collected into laboratory-supplied containers, stored on ice, and shipped to the laboratory.

5.4 Soil Assessment

Soil samples will be collected from the upper 2-feet of the soil column for PFAS analysis. Samples will be collected using decontaminated stainless-steel sampling equipment. Equipment blanks will be collected each day that soil sampling is completed. Once collected, samples will be placed in laboratory-supplied containers stored on ice and delivered to the laboratory.

5.5 Surface Water Assessment

Surface water in Area 4 will be sampled via grab samples directly into the sample bottle from the edge of the retention pond. Fluoropolymer-free materials will be used to collect the sample from a location away from the shoreline. Special care will be taken to prevent disturbance of sediments. Samples will not be field filtered. An equipment blank will be collected each day that surface water sampling is completed.

The sample will be collected into laboratory-supplied containers, stored on ice, and shipped to the laboratory.

5.6 Supplemental/Contingency Assessment

TVC is requesting contingency funds as part of the grant that will be utilized pending completion of the activities proposed above. Given the unknowns associated with potential PFAS-impacts at Cherry Capital Airport, as well as other possible sources downgradient of the airport, the best use of these funds may change; however, at this time, contingency funds are requested to complete the following to the extent they are indicated as necessary:

1. Sampling of private, downgradient groundwater supply wells
2. Installation and sampling of downgradient monitoring wells

5.6.1 Contingency Task 1 – Residential Well Sampling

According to GeoWebFace, thirty-six private water supplies (Attachment 2 – Figure 3) are believed to exist northeast of the airport property. Depending upon the results of the initial investigation activities, private wells may be included in a private water supply well sampling program. Private water supply wells may be selected for sampling based upon a well’s proximity to the groundwater flow direction axis through a PFAS-impacted groundwater plume(s) determined during groundwater sampling activities.

To ensure that a reasonable effort is made to assess private water supply wells in the potentially affected area(s), water well installation records will be cross-referenced with water distribution records from local municipalities to determine the water supply source for parcels of interest. This effort will help determine if private water supply wells exist in the area that have not been digitized into GeoWebFace or if wells shown in GeoWebFace have since been abandoned.

The owner of any private water supply well of interest will be contacted and access requested to sample the well. Water samples will be collected for analysis from the tap closest to the water well in accordance with the QAPP. If analytical testing indicates an exceedance of EGLE criteria, then a request will be made and the location resampled. For the purpose of this proposal, we estimate a total of forty-five private water well and QAQC samples may be collected as part of this contingency task.

5.6.2 Contingency Task 2 – Downgradient Monitoring Wells

Using the methods described above and in the QAPP, additional groundwater monitoring wells may be required to assess potential impacts to downgradient receptors. The locations of these additional monitoring wells will be determined based upon results of initial groundwater sampling activities. It is anticipated that up to five downgradient monitoring wells will be installed in public rights-of-way with approval of the appropriate municipality.

Sampling of these wells will be completed concurrently with remaining quarterly sampling events. The sampling of the additional contingency monitoring wells will replace the sampling of five lesser-impacted upgradient monitoring wells.

6.0 PROJECT REPORTING

Quarterly reports will be submitted to MDOT within 30 days of the end of each quarter. The reports will include, at a minimum:

- Summary of work completed during quarter
- Analytical data for all samples collected in raw, tabulated, and spatial formats
- Groundwater elevation and geochemical data
- Summary of work anticipated in forthcoming quarter
- Other items required by MDOT guidance

A final project report will be submitted within 30 days of the end of the grant period. This report will summarize the efforts reported in the quarterly updates and will include an evaluation of the assessment results. The final report will follow guidance provided by EGLE in accordance with the grant.

7.0 PROJECT SCHEDULE

The proposed assessment and reporting work are expected to take the 18 months allowed by the grant. A summary of the anticipated project schedule is provided in Table 3.

TABLE 3 ANTICIPATED SCHEDULE

Task Name	Start	Finish	2021				2022							
			Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2			
Grant Award	Tue 9/15/20	Tue 9/15/20			◆ 9/15									
Quarterly Reporting	Fri 1/29/21	Fri 1/28/22												
Area 4 Surface Water Sampling	Mon 11/2/20	Mon 11/2/20												
Soil Sampling	Mon 11/2/20	Wed 11/4/20												
Monitoring Well Installation	Mon 11/16/20	Fri 11/27/20			■									
Quarterly Groundwater Sampling	Mon 12/14/20	Fri 9/17/21												
Contingency - Downgradient Well Installation	Mon 5/3/21	Fri 5/7/21												
Contingency - Private Well Sampling	Mon 5/3/21	Fri 6/25/21					■							
Final Report Due	Tue 3/15/22	Tue 3/15/22												◆ 3/15

8.0 GRANT REQUEST

Cherry Capital Airport is requesting \$249,981.00 to complete the described assessment activities. Consultant fees will be billed on a time and materials basis at rates that do not exceed the EPA consultant cap. The budget summary provided in Table 4 is broken down into labor, contractor, and material expense categories. The labor category includes personnel from Gosling Czubak Engineering Sciences, our primary consultant for the project. The Contractor category includes waste disposal services provided by Northern A-1 and laboratory fees for Pace Analytical Services, LLC. Additional budget detail is available in Attachment 5.

TABLE 4 BUDGET SUMMARY

ITEM DESCRIPTION	LABOR	CONTRACTOR	MATERIALS	SUBTOTAL
Administration & Reporting	\$20,435.00	\$ -	\$ -	\$20,435.00
Surface Water Sampling	\$3,140.00	\$3,030.00	\$21.00	\$6,191.00
Soil Sampling	\$4,675.00	\$7,590.00	\$27.00	\$12,292.00
Monitoring Well Installation	\$35,527.50	\$27,105.00	\$6,986.00	\$69,618.50
Quarterly Groundwater Sampling	\$28,220.00	\$38,880.00	\$2,440.00	\$69,540.00
Private Well Sampling	\$7,600.00	\$16,200.00	\$56.00	\$23,856.00
Downgradient Monitoring Well Installation	\$24,347.50	\$20,055.00	\$3,646.00	\$48,048.50
			Total	\$249,981.00

Attachment 1

Eligibility Support Documents

Airport Contacts Information

ALL FAA REGIONS
 ALL FAA DISTRICTS
 STATE OF MICHIGAN
 COUNTY OF GRAND TRAVERSE
 CITY OF TRAVERSE CITY
 PUBLIC-USE FACILITIES
 PART 139 CERTIFICATED

Data Source: [28 Day NASR Subscription](#)

Effective Date: 04/23/2020

Region Code: Linked to the Associated Airports Regional web site.

Location Identifier: Linked to data provided by [Airport Data and Information Portal - Repository Search](#) (Includes Airport Master Records, FAA Form 5010-1, and Airport Charts and Diagrams).

Site Number: Linked to data provided by [Aeronautical Information Services Airport Data](#).

Airport Reference Point Coordinates: Linked to airport location in Google Maps.

Cert. Type & Date: Format is the class code ('I', 'II', 'III' or 'IV') followed by a one character code A, B, C, D, E, or L, followed by a one character code S or U, followed by the month and year of certification. (ex. 'I A S 07/1980', 'I C S 01/1983' or 'I A U 09/1983').

- Codes A, B, C, D, and E are for airports having a full certificate under CFR Part 139, and receiving scheduled air carrier service from carriers certificated by the CAB, and identify the AREF index for the airport.
- Code L is for airports having limited certification under CFR Part 139.
- Code S is for airports receiving scheduled air carrier service from carriers certificated by the CAB.
- Code U is for airports not receiving this scheduled service.

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State	Region	City	Facility Name	Location ID	Airport Reference	Cert. Type	Manager Name	Owner Name	Phone
ADO	County	Ownership/Use	Site Number	Point Coordinates	& Date	Address	Address	Address	Number(s)
MI	TRAVERSE CITY	CHERRY	TVC	44-44-29.7000N	I B S	KEVIN C. KLEIN, A.A.E.	GRAND TRAVERSE & LEELANAU	M - 231-947-	
AGL	GRAND	CAPITAL	10379.*A	085-34-54.7000W	05/1973	727 FLY DON'T DRIVE	CO	2250	
DET	TRAVERSE	PU/PU				TRAVERSE CITY, MI	NORTHWESTERN RGNL ARPT	O - 231-947-	
						49686	CMSN	2250	
							TRAVERSE CITY, MI 49686		

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Entity Dashboard

NORTHWESTERN REGIONAL AIRPORT COMMISSION

727 Fly Dont Dr Ste 1

DUNS: 119695724 CAGE Code: 34LQ3

Traverse City, MI, 49686-3591 ,

Status: Active

UNITED STATES

Expiration Date: 05/08/2021

Purpose of Registration: Federal Assistance Awards Only

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Attachment 2

Background Environmental Information

MATERIAL SAFETY
DATA SHEET

CHEMGUARD 3% AFFF C-301MS

Revision Date: 1/25/2006

1. PRODUCT IDENTIFICATION

Chemical Family: Surfactant mixture; fire fighting foam concentrate

Product name: Chemguard 3% AFFF **C-301MS**
Aqueous Film Forming Foam

Manufacturer: Chemguard, Inc.
204 South 6th Ave.
Mansfield, TX 76063
emergency phone: 817-473-9964

2. COMPOSITION / INFORMATION ON INGREDIENTS

<u>CAS NO.</u>	<u>Common Name</u>	<u>ACGIH/PPM</u>		<u>OSHA/PPM</u>	
		<u>TWA</u>	<u>STEL</u>	<u>PEL</u>	<u>% by wt</u>
7732-18-5	water				70%-80%
112-34-5	diethylene glycol mono butyl ether	N/A	N/A	N/A	6 - 8%
7487-88-9	magnesium sulfate	N/A	N/A	N/A	0.5%-1.5%
64-02-8	ethylenediaminetetraacetic acid tetrasodium salt				0.5%-1.5%
proprietary	proprietary hydrocarbon surfactant	N/A	N/A	N/A	proprietary
proprietary	proprietary fluorosurfactant	N/A	N/A	N/A	proprietary

3. HAZARDS IDENTIFICATION

Routes of entry: Dermal, inhalation and ingestion

Potential Health Effects: May cause skin and eye irritation.

Carcinogenicity: Not a carcinogen.

4. FIRST AID MEASURES

Ingestion: Do not induce vomiting. Call a physician.

Inhalation: Remove to fresh air.

Skin: Rinse with water. Wash with soap and water. Contaminated clothing should be washed before re-use.

Eyes: Rinse with water. Call a physician.

5. FIRE FIGHTING MEASURES

Flash Point:	no flash to boiling
Flammable Limits in air (lower % by volume):	not evaluated
Flammable Limits in air (upper % by volume):	not evaluated
Auto-ignition Temperature:	not evaluated

General Hazards: None known.

Fire Fighting Equipment: Self contained breathing apparatus

Fire Extinguishing Media: Water, Foam, Carbon Dioxide, Dry Chemical, Halon

Fire and Explosion Hazards: Decomposition products may be toxic.

Hazardous Combustion Products: various oxides of carbon, sulfur and nitrogen

6. ACCIDENTAL RELEASE

Contain spills. Vacuum or pump into storage containers, absorb smaller quantities with absorbent materials, and dispose of properly. Washing area with water will create large amounts of foam.

Dispose of released and contained material in accordance with local, state, and federal regulations. Release to local waste treatment plant only with permission.

7. HANDLING AND STORAGE

Store in original container, or appropriate end-use device. Store at temperatures of 35 - 120 degrees F. If the material freezes, it may be thawed without loss of performance.

8. EXPOSURE CONTROLS, PERSONAL PROTECTION

Eye Protection: Wear side-shield safety glasses.

Skin Protection: Wear latex gloves.

Respiratory Protection: Use organic vapor respirator if needed.

9. PHYSICAL AND CHEMICAL PROPERTIES

Boiling Point:	212°F
Melting Point:	27°F
Specific Gravity:	1.079
Vapor Pressure (mm Hg):	N/D
pH	7.0 - 8.5
Flash Point (PMCC):	no flash to boiling
Vapor Density (air = 1)	N/D
Solubility in water:	100%
Appearance:	clear yellow liquid
Odor:	faint chemical odor

10. STABILITY AND REACTIVITY

Stability: Stable

Incompatibility: Strong oxidizers

Hazardous Polymerization: Will not occur.

Decomposition Products: Oxides of nitrogen, sulfur, carbon.

11. TOXICOLOGICAL INFORMATION

Eye Irritation: (Rabbits) mild irritant

Skin Irritation: (Rabbits) minimal irritant

Inhalation Toxicity: not evaluated

Sensitization: not evaluated

Teratology: not evaluated

Mutagenicity: not evaluated

Reproduction: not evaluated

Acute Oral Effects (Rats): not evaluated

12. ECOLOGICAL INFORMATION

	<u>CONCENTRATE</u>	<u>SOLUTION AS USED</u>
Chemical Oxygen Demand:	260,544 mg/l	7,816 mg/l
Biological Oxygen Demand (20 day):	330,890 mg/l	9,927 mg/l
Biodegradability (B.O.D./C.O.D.):	99.90%	99.90%
Total Organic Carbon:	not determined	not determined
LC50 96 day (fundulus heteroclitus)	1134 mg/l	37,800 mg/l

13. DISPOSAL CONSIDERATIONS

Dispose in accordance with local, state, and federal regulations. Discharge to waste treatment plants only with permission. Anti-foam agents may be used to reduce foaming in waste streams.

14. TRANSPORTATION INFORMATION

Department of Transportation proper shipping name: not regulated

Hazard class: None

UN Number: None

15. REGULATORY INFORMATION

All ingredients are on the **TSCA** inventory.

No components are reportable under **SARA Title III, sec. 313**

No components are priority pollutants listed under the U.S. Clean Water Act Section 307 (2)(1)

Priority Pollutant List (**40 CFR 401.15**).

No components are reportable under **CERCLA**.

16. OTHER INFORMATION

NFPA Hazard Ratings

1

0

0

Health Hazard Rating

Flammability Rating

Instability/Reactivity Rating

HMIS Identification System

1

0

0

Change Log:

Revision 2, 1/25/06 - Revision date changed.

Safety Data Sheet

This safety data sheet complies with the requirements of: 2012 OSHA Hazard Communication Standard (29CFR 1910.1200)

Product name CHEMGUARD C301MS

1. Identification

1.1. Product Identifier

Product name CHEMGUARD C301MS

1.2. Other means of identification

Product code C301D
Synonyms None
Chemical Family Fire fighting foam, surfactant

1.3. Recommended use of the chemical and restrictions on use

Recommended use Fire extinguishing agent.
Uses advised against None known.

1.4. Details of the Supplier of the Safety Data Sheet

Company Name Chemguard, Inc
204 South 6th Ave
Mansfield, TX 76063
Telephone: 817-473-9964
www.chemguard.com
Contact point Product Stewardship at 1-715-735-7411
E-mail address psra@tycofp.com

1.5. Emergency Telephone Number

Emergency telephone CHEMTREC 001-800-424-9300 or 001-703-527-3887

2. Hazards Identification

Classification

This chemical is considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200)

Serious eye damage/eye irritation - Category 1

2.2. Label Elements

Signal Word

DANGER

Hazard Statements

Causes serious eye damage



Precautionary Statements

Prevention

Wear protective gloves/protective clothing/eye protection/face protection.

IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a POISON CENTER or doctor/physician.

2.3. Hazards Not Otherwise Classified (HNOC)

Not Applicable.

2.4. Other Information

Harmful to aquatic life with long lasting effects. Harmful to aquatic life.

3. Composition/information on Ingredients

3.1. Mixture

The following component(s) in this product are considered hazardous under applicable OSHA(USA)

Chemical name	CAS No.	weight-%
Sucrose	57-50-1	5 - 10
Sodium Octyl Sulfate	142-31-4	3 - 7
2-(2-Butoxyethoxy)ethanol	112-34-5	1 - 5
Polyfluorinated alkyl polyamide	Proprietary	1 - 5
Ethylene Diamine Tetraacetic Acid, Sodium Salt	64-02-8	1 - 5

4. First aid measures

4.1. Description of first aid measures

General Advice	Keep victim under observation. Move victim to a safe isolated area. Move victim to fresh air. Remove contaminated clothing and shoes.
Eye Contact	Rinse thoroughly with plenty of water for at least 15 minutes, lifting lower and upper eyelids. Consult a physician.
Skin contact	Wash skin with soap and water. Get medical attention if irritation develops and persists.
Inhalation	Remove to fresh air. If breathing is difficult, give oxygen. (Get medical attention immediately if symptoms occur.).
Ingestion	Rinse mouth. Do not induce vomiting without medical advice. If swallowed, call a poison control center or physician immediately.

4.2. Most Important Symptoms and Effects, Both Acute and Delayed

Symptoms No information available.

4.3. Indication of Any Immediate Medical Attention and Special Treatment Needed

Note to physicians Treat symptomatically.

5. Fire-fighting measures

5.1. Suitable Extinguishing Media

Use extinguishing measures that are appropriate to local circumstances and the surrounding environment.

5.2. Unsuitable Extinguishing Media

None.

5.3. Specific Hazards Arising from the Chemical

None known.

**Hazardous Combustion
Products**

Carbon oxides, Fluorinated oxides, Nitrogen oxides (NOx), Oxides of sulfur

5.4. Explosion Data**Sensitivity to Mechanical Impact** None.**Sensitivity to Static Discharge** None.**5.5. Protective Equipment and Precautions for Firefighters**

As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

6. Accidental release measures**6.1. Personal precautions, protective equipment and emergency procedures****Personal Precautions**

Ensure adequate ventilation, especially in confined areas.

For emergency responders

Use personal protection recommended in Section 8.

6.2. Environmental Precautions**Environmental Precautions**

Prevent further leakage or spillage if safe to do so. Prevent entry into waterways, sewers, basements or confined areas. See Section 12 for additional Ecological Information.

6.3. Methods and material for containment and cleaning up**Methods for Containment**

Prevent further leakage or spillage if safe to do so.

Methods for Cleaning Up

Pick up and transfer to properly labeled containers.

7. Handling and Storage**7.1. Precautions for Safe Handling****Advice on safe handling**

Avoid contact with skin and eyes. Handle in accordance with good industrial hygiene and safety practice.

7.2. Conditions for safe storage, including any incompatibilities**Storage Conditions**

Keep containers tightly closed in a dry, cool and well-ventilated place.

Incompatible Materials

Strong oxidizing agents. Strong acids. Strong bases.

8. Exposure Controls/Personal Protection**8.1. Control Parameters****Exposure guidelines**

Chemical name	ACGIH TLV	OSHA PEL	NIOSH IDLH	Mexico OEL
Sucrose 57-50-1	TWA: 10 mg/m ³	-	TWA: 10 mg/m ³ total dust TWA: 5 mg/m ³ respirable dust	TWA 10 mg/m ³ (VLE-PPT) STEL 20 mg/m ³ (PPT-CT)
2-(2-Butoxyethoxy)ethanol 112-34-5	TWA: 10 ppm inhalable fraction and vapor	-	-	-

ACGIH (American Conference of Governmental Industrial Hygienists) OSHA (Occupational Safety and Health Administration of the US Department of Labor) NIOSH IDLH Immediately Dangerous to Life or Health

8.2. Appropriate Engineering Controls

Engineering controls Ensure adequate ventilation, especially in confined areas.

8.3. Individual protection measures, such as personal protective equipment

Eye/Face Protection Avoid contact with eyes. Tight sealing safety goggles.

Skin and Body Protection Wear protective gloves and protective clothing.

Respiratory Protection If exposure limits are exceeded or irritation is experienced, NIOSH/MSHA approved respiratory protection should be worn. Positive-pressure supplied air respirators may be required for high airborne contaminant concentrations. Respiratory protection must be provided in accordance with current local regulations.

Ventilation Use local exhaust or general dilution ventilation to control exposure with applicable limits

8.4. General hygiene considerations

Do not eat, drink or smoke when using this product. Handle in accordance with good industrial hygiene and safety practice.

9. Physical and Chemical Properties

9.1. Information on basic physical and chemical properties

Physical State	Liquid	Color	Clear Yellow
Odor	Slight		
Odor Threshold	No data available		

<u>Property</u>	<u>Values</u>	<u>Remarks • Method</u>
pH	7.7 - 8.7	
Melting point/freezing point	0 °C / 32 °F	
Boiling point / boiling range	100 °C / 212 °F	
Flash Point	> 100 °C / > 212 °F	
Evaporation Rate	No data available	
Flammability (solid, gas)	No data available	
Flammability limit in air		
Upper flammability limit:	No data available	
Lower flammability limit:	No data available	
Vapor Pressure	No data available	
Vapor Density	No data available	
Specific gravity	1.00 - 1.25	
Water Solubility	Completely soluble	
Solubility in Other Solvents	No data available	
Partition coefficient	No data available	
Autoignition Temperature	No data available	
Decomposition Temperature	No data available	
Kinematic viscosity	No data available	

VOC content (%) 2.514

10. Stability and Reactivity**10.1. Chemical Stability**

Stable under recommended storage conditions.

10.2. Reactivity

No data available

10.3. Possibility of hazardous reactions

None under normal processing.

Hazardous Polymerization

Hazardous polymerization does not occur.

10.4. Conditions to Avoid

Extremes of temperature and direct sunlight.

10.5. Incompatible Materials

Strong oxidizing agents. Strong acids. Strong bases.

10.6. Hazardous decomposition products

Carbon oxides. Nitrogen oxides (NOx). Oxides of sulfur. Fluorinated oxides.

11. Toxicological Information**11.1. Information on Likely Routes of Exposure**

Product information	No data available
Inhalation	No data available.
Eye Contact	Corrosive to the eyes and may cause severe damage including blindness.
Skin contact	May cause irritation.
Ingestion	No data available.

Component Information**Acute Toxicity**

Chemical name	Oral LD50	Dermal LD50	Inhalation LC50
Sucrose 57-50-1	= 29700 mg/kg (Rat)	-	-
Sodium Octyl Sulfate 142-31-4	= 3200 mg/kg (Rat)	-	-
2-(2-Butoxyethoxy)ethanol 112-34-5	= 5660 mg/kg (Rat)	= 2700 mg/kg (Rabbit)	-
Ethylene Diamine Tetraacetic Acid, Sodium Salt 64-02-8	= 10 g/kg (Rat) = 1658 mg/kg (Rat)	-	-

11.2. Information on Toxicological Effects

Symptoms No information available.

11.3. Delayed and immediate effects as well as chronic effects from short and long-term exposure

Skin Corrosion/Irritation Irritating to skin.
Serious eye damage/eye irritation Risk of serious damage to eyes.
Carcinogenicity No information available.
Reproductive Toxicity No information available.
STOT - Single Exposure No information available.
STOT - Repeated Exposure No information available.
Target organ effects Eyes, Respiratory System.
Aspiration Hazard No information available.

11.4. Numerical Measures of Toxicity - Product information

The following values are calculated based on chapter 3.1 of the GHS document

ATEmix (oral) 18763 mg/kg

12. Ecological Information

12.1. Ecotoxicity

Harmful to aquatic life with long lasting effects.

Chemical name	Algae/aquatic plants	Fish	Crustacea
2-(2-Butoxyethoxy)ethanol 112-34-5	EC50 (96h) > 100 mg/L Desmodesmus subspicatus	LC50 (96h) static = 1300 mg/L Lepomis macrochirus	EC50 (48h) > 100 mg/L Daphnia magna EC50 (24h) = 2850 mg/L Daphnia magna
Ethylene Diamine Tetraacetic Acid, Sodium Salt 64-02-8	EC50 (72h) = 1.01 mg/L Desmodesmus subspicatus	LC50 (96h) static = 41 mg/L Lepomis macrochirus LC50 (96h) static = 59.8 mg/L Pimephales promelas	EC50 (24h) = 610 mg/L Daphnia magna
2-Methyl-2,4-pentanediol 107-41-5	-	LC50 (96h) static = 10700 mg/L Pimephales promelas LC50 (96h) static = 10000 mg/L Lepomis macrochirus LC50 (96h) flow-through = 8690 mg/L Pimephales promelas LC50 (96h) flow-through 10500 - 11000 mg/L Pimephales promelas	EC50 (48h) 2700 - 3700 mg/L Daphnia magna
t-Butanol 75-65-0	EC50 (72h) > 1000 mg/L Desmodesmus subspicatus	LC50 (96h) flow-through 6130 - 6700 mg/L Pimephales promelas	EC50 (48h) = 933 mg/L Daphnia magna EC50 (48h) Static 4607 - 6577 mg/L Daphnia magna
Sodium Hydroxide 1310-73-2	-	LC50 (96h) static = 45.4 mg/L Oncorhynchus mykiss	-
Polyethylene Glycol 25322-68-3	-	LC50 (24h) > 5000 mg/L Carassius auratus	-
Trisodium nitrilotriacetate 5064-31-3	EC50 (96h) 560 - 1000 mg/L Chlorella vulgaris	LC50 (96h) semi-static 560 - 1000 mg/L Oryzias latipes LC50 (96h) static 72 - 133 mg/L Oncorhynchus mykiss LC50 (96h) flow-through 93 - 170 mg/L Pimephales promelas LC50 (96h) 560 - 1000 mg/L Poecilia reticulata LC50 (96h) static 175 - 225 mg/L Lepomis macrochirus LC50 (96h) 560 - 1000 mg/L Oryzias latipes LC50 (96h) semi-static 560 - 1000 mg/L Poecilia reticulata LC50 (96h) static = 470 mg/L Pimephales promelas LC50 (96h) = 114 mg/L Pimephales promelas LC50 (96h) = 252 mg/L Lepomis macrochirus	LC50 (48h) 560 - 1000 mg/L Daphnia magna

5-Chloro-2-methyl-4-isothiazolin-3-one 26172-55-4	EC50 (96h) static 0.03 - 0.13 mg/L Pseudokirchneriella subcapitata EC50 (72h) static 0.11 - 0.16 mg/L Pseudokirchneriella subcapitata EC50 (120h) = 0.31 mg/L Anabaena flos-aquae	LC50 (96h) semi-static = 1.6 mg/L Oncorhynchus mykiss	EC50 (48h) Flow through 0.12 - 0.3 mg/L Daphnia magna EC50 (48h) Static 0.71 - 0.99 mg/L Daphnia magna EC50 (48h) = 4.71 mg/L Daphnia magna
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12.2. Persistence and Degradability

Biodegradability (B.O.D./C.O.D.) 99.9 %

12.3. Bioaccumulation

No information available.

12.4. Other Adverse Effects

No information available

13. Disposal Considerations**13.1. Waste Treatment Methods****Disposal of wastes**

Disposal should be in accordance with applicable regional, national and local laws and regulations.

Contaminated Packaging

Do not reuse container.

14. Transport Information**DOT** NOT REGULATED**TDG** NOT REGULATED**MEX** NOT REGULATED**ICAO (air)** NOT REGULATED**IATA** NOT REGULATED**IMDG** NOT REGULATED**15. Regulatory Information****15.1. International Inventories**

TSCA	Complies
DSL/NDSL	Does not comply
ENCS	Does not comply
IECSC	Does not comply
KECL	Complies
PICCS	Does not comply
AICS	Complies

Legend:

TSCA - United States Toxic Substances Control Act Section 8(b) Inventory

DSL/NDL - Canadian Domestic Substances List/Non-Domestic Substances List

ENCs - Japan Existing and New Chemical Substances

IECSC - China Inventory of Existing Chemical Substances

KECL - Korean Existing and Evaluated Chemical Substances

PICCS - Philippines Inventory of Chemicals and Chemical Substances

AICS - Australian Inventory of Chemical Substances

15.2. US Federal Regulations**SARA 313**

Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 (SARA). This product contains a chemical or chemicals which are subject to the reporting requirements of the Act and Title 40 of the Code of Federal Regulations, Part 372

Chemical name	SARA 313 - Threshold Values %
2-(2-Butoxyethoxy)ethanol - 112-34-5	1.0

SARA 311/312 Hazard Categories

Acute Health Hazard	Yes
Chronic health hazard	No
Fire Hazard	No
Sudden Release of Pressure Hazard	No
Reactive Hazard	No

CWA (Clean Water Act)

This product does not contain any substances regulated as pollutants pursuant to the Clean Water Act (40 CFR 122.21 and 40 CFR 122.42)

CERCLA

This material, as supplied, does not contain any substances regulated as hazardous substances under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302) or the Superfund Amendments and Reauthorization Act (SARA) (40 CFR 355). There may be specific reporting requirements at the local, regional, or state level pertaining to releases of this material

15.3. US State Regulations**California Proposition 65**

This product contains the following Proposition 65 chemicals

Chemical name	California Proposition 65
Perfluorooctanoic acid - 335-67-1	Developmental Toxicity

U.S. State Right-to-Know Regulations

Chemical name	New Jersey	Massachusetts	Pennsylvania
2-(2-Butoxyethoxy)ethanol 112-34-5	X	-	X
Trisodium nitrilotriacetate 5064-31-3	-	X	-
Magnesium Nitrate 10377-60-3	X	X	X

16. Other information, including date of preparation of the last revision

NFPA	Health Hazards 2	Flammability 1	Instability 0	Physical and chemical properties -
HMIS	Health Hazards 2	Flammability 1	Physical Hazards 0	Personal Protection X

Revision date 13-Jan-2019

Revision note No information available.

Disclaimer

The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.

End of Safety Data Sheet



Safety Data Sheet

This safety data sheet complies with the requirements of: 2012 OSHA Hazard Communication Standard (29CFR 1910.1200)

Product name Ansulite AFC-5A 3% AFFF

1. Identification

1.1. Product Identifier

Product name Ansulite AFC-5A 3% AFFF

1.2. Other means of identification

Product code 068122
Synonyms None
Chemical Family No information available

1.3. Recommended use of the chemical and restrictions on use

Recommended use Fire extinguishing agent.
Uses advised against Consumer use.

1.4. Details of the Supplier of the Safety Data Sheet

Company Name Tyco Fire Protection Products
One Stanton Street
Marinette, WI 54143-2542
Telephone: 715-735-7411
Contact point Product Stewardship at 1-715-735-7411
E-mail address psra@tycofp.com

1.5. Emergency Telephone Number

Emergency telephone CHEMTREC 800-424-9300 or 703-527-3887

2. Hazards Identification

Classification

This chemical is considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200)

Serious eye damage/eye Irritation - Category 2A

2.2. Label Elements

Signal Word

WARNING

Hazard Statements

Causes serious eye irritation



Precautionary Statements



Product code 068122

Product name Ansulite AFC-5A /
3% AFFF

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Prevention

Wash face, hands and any exposed skin thoroughly after handling. Wear eye/face protection.

IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Get medical advice/attention.

2.3. Hazards Not Otherwise Classified (HNOC)

Not Applicable.

2.4. Other Information

Unknown Acute Toxicity 23.6318% of the mixture consists of ingredient(s) of unknown toxicity

3. Composition/information on Ingredients

3.1. Mixture

The following component(s) in this product are considered hazardous under applicable OSHA(USA)

Chemical name	CAS No.	weight-%
2-(2-Butoxyethoxy)ethanol	112-34-5	10 - 30
Polyfluorinated alkyl polyamide	Proprietary	1 - 5
Anionic Fluorinated Surfactant	Proprietary	1 - 5
Octylphenoxypolyethoxyethanol	9036-19-5	1 - 5
Lauryl Imino Propionate, Sodium Salt	14960-06-6	1 - 5

4. First aid measures

4.1. Description of first aid measures

Eye Contact	Rinse thoroughly with plenty of water for at least 15 minutes, lifting lower and upper eyelids. Consult a physician.
Skin contact	Wash skin with soap and water. Get medical attention if irritation develops and persists.
Inhalation	Remove to fresh air. If breathing is difficult, give oxygen. (Get medical attention immediately if symptoms occur.)
Ingestion	Rinse mouth. Do not induce vomiting without medical advice. If swallowed, call a poison control center or physician immediately.

4.2. Most Important Symptoms and Effects, Both Acute and Delayed

Symptoms No information available.

4.3. Indication of Any Immediate Medical Attention and Special Treatment Needed

Note to physicians Treat symptomatically.

5. Fire-fighting measures

5.1. Suitable Extinguishing Media

Product is extinguishing agent. Use extinguishing measures that are appropriate to local circumstances and the surrounding environment.



Product code 068122

Product name Ansulite AFC-5A /
3% AFFF

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5.2. Unsuitable Extinguishing Media

None.

5.3. Specific Hazards Arising from the Chemical

None known.

Hazardous Combustion Products

Carbon oxides, Fluorinated oxides, Nitrogen oxides (NOx), Oxides of sulfur

5.4. Explosion Data

Sensitivity to Mechanical Impact None.

Sensitivity to Static Discharge None.

5.5. Protective Equipment and Precautions for Firefighters

As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

6. Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures

Personal Precautions Ensure adequate ventilation, especially in confined areas.

For emergency responders Use personal protection recommended in Section 8.

6.2. Environmental Precautions

Environmental Precautions Prevent further leakage or spillage if safe to do so. Prevent entry into waterways, sewers, basements or confined areas. See Section 12 for additional Ecological Information.

6.3. Methods and material for containment and cleaning up

Methods for Containment Prevent further leakage or spillage if safe to do so.

Methods for Cleaning Up Pick up and transfer to properly labeled containers.

7. Handling and Storage

7.1. Precautions for Safe Handling

Advice on safe handling Avoid contact with skin and eyes. Handle in accordance with good industrial hygiene and safety practice.

7.2. Conditions for safe storage, including any incompatibilities

Storage Conditions Keep containers tightly closed in a dry, cool and well-ventilated place.

Incompatible Materials Strong oxidizing agents. Strong acids. Strong bases.

8. Exposure Controls/Personal Protection



Product code 068122

Product name Ansulite AFC-5A / 3% AFFF

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8.1. Control Parameters

Exposure guidelines

Chemical name	ACGIH TLV	OSHA PEL	NIOSH IDLH	Mexico OEL
2-(2-Butoxyethoxy)ethanol 112-34-5	TWA: 10 ppm inhalable fraction and vapor	-	-	-

ACGIH (American Conference of Governmental Industrial Hygienists) OSHA (Occupational Safety and Health Administration of the US Department of Labor) NIOSH IDLH Immediately Dangerous to Life or Health

8.2. Appropriate Engineering Controls

Engineering controls: Showers, Eyewash stations, Ventilation systems.

8.3. Individual protection measures, such as personal protective equipment

Eye/Face Protection: Avoid contact with eyes. Tight sealing safety goggles.
Skin and Body Protection: Wear protective gloves and protective clothing.
Respiratory Protection: If exposure limits are exceeded or irritation is experienced, NIOSH/MSHA approved respiratory protection should be worn.
Ventilation: Use local exhaust or general dilution ventilation to control exposure with applicable limits

8.4. General hygiene considerations

Do not eat, drink or smoke when using this product. Handle in accordance with good industrial hygiene and safety practice.

9. Physical and Chemical Properties

9.1. Information on basic physical and chemical properties

Physical State: Liquid
Odor: Characteristic
Odor Threshold: No data available
Color: Light yellow

Property	Values	Remarks • Method
pH	7	
Melting point/freezing point	No data available	
Boiling point / boiling range	> 100 °C / 212 °F	
Flash Point	> 100 °C / > 212 °F	
Evaporation Rate	No data available	
Flammability (solid, gas)	No data available	
Flammability limit in air		
Upper flammability limit:	No data available	
Lower flammability limit:	No data available	
Vapor Pressure	No data available	
Vapor Density	No data available	
Specific gravity	No data available	
Water Solubility	No data available	
Solubility in Other Solvents	No data available	



Product code 068122

Product name Ansulite AFC-5A /
3% AFFF

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Partition coefficient No data available
Autoignition Temperature No data available
Decomposition Temperature No data available
Kinematic viscosity No data available

10. Stability and Reactivity

10.1. Chemical Stability

Stable under recommended storage conditions.

10.2. Reactivity

No data available

10.3. Possibility of hazardous reactions

None under normal processing.

Hazardous Polymerization Hazardous polymerization does not occur.

10.4. Conditions to Avoid

Extremes of temperature and direct sunlight.

10.5. Incompatible Materials

Strong oxidizing agents. Strong acids. Strong bases.

10.6. Hazardous decomposition products

Carbon oxides. Nitrogen oxides (NOx). Oxides of sulfur. Fluorinated oxides.

11. Toxicological Information

11.1. Information on Likely Routes of Exposure

Product information No data available

Inhalation No data available.

Eye Contact Severely irritating to eyes.

Skin contact May cause irritation.

Ingestion No data available.

Component Information

Acute Toxicity

Chemical name	Oral LD50	Dermal LD50	Inhalation LC50
2-(2-Butoxyethoxy)ethanol 112-34-5	= 5660 mg/kg (Rat)	= 2700 mg/kg (Rabbit)	-
Anionic Fluorinated Surfactant	> 10,000 ppm (Rat)	-	-
Octylphenoxyethoxyethanol 9036-19-5	= 1700 mg/kg (Rat) = 4190 mg/kg (Rat)	-	-



Product code 068122

Product name Ansulite AFC-5A /
3% AFFF

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11.2. Information on Toxicological Effects

Symptoms No information available.

11.3. Delayed and immediate effects as well as chronic effects from short and long-term exposure

Skin Corrosion/Irritation Irritating to skin.
Serious eye damage/eye irritation Severely irritating to eyes.
Sensitization No information available.
Germ Cell Mutagenicity No information available.
Carcinogenicity No information available.
Reproductive Toxicity No information available.
STOT - Single Exposure No information available.
STOT - Repeated Exposure No information available.
Aspiration Hazard No information available.

11.4. Numerical Measures of Toxicity - Product information

The following values are calculated based on chapter 3.1 of the GHS document

ATEmix (oral) 12900 mg/kg
 ATEmix (dermal) 14982 mg/kg

12. Ecological Information

12.1. Ecotoxicity

Not classified.

0.042% of the mixture consists of components(s) of unknown hazards to the aquatic environment

Chemical name	Algae/aquatic plants	Fish	Crustacea
2-(2-Butoxyethoxy)ethanol 112-34-5	EC50 (96h) > 100 mg/L Desmodesmus subspicatus	LC50 (96h) static = 1300 mg/L Lepomis macrochirus	EC50 (48h) > 100 mg/L Daphnia magna EC50 (24h) = 2850 mg/L Daphnia magna
2-Methyl-2,4-pentanediol 107-41-5	-	LC50 (96h) static = 10700 mg/L Pimephales promelas LC50 (96h) flow-through = 8690 mg/L Pimephales promelas LC50 (96h) flow-through 10500 - 11000 mg/L Pimephales promelas LC50 (96h) static = 10000 mg/L Lepomis macrochirus	EC50 (48h) 2700 - 3700 mg/L Daphnia magna
t-Butanol 75-65-0	EC50 (72h) > 1000 mg/L Desmodesmus subspicatus	LC50 (96h) flow-through 6130 - 6700 mg/L Pimephales promelas	EC50 (48h) = 933 mg/L Daphnia magna EC50 (48h) Static 4607 - 6577 mg/L Daphnia magna
Polyethylene Glycol 25322-68-3	-	LC50 (24h) > 5000 mg/L Carassius auratus	-

12.2. Persistence and Degradability

No information available.

12.3. Bioaccumulation

No information available.



Product code 068122

Product name Ansulite AFC-5A / 3% AFFF

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12.4. Other Adverse Effects

No information available

13. Disposal Considerations

13.1. Waste Treatment Methods

Disposal of wastes

Disposal should be in accordance with applicable regional, national and local laws and regulations.

Contaminated Packaging

Do not reuse container.

14. Transport Information

DOT

NOT REGULATED

TDG

NOT REGULATED

MEX

NOT REGULATED

ICAO (air)

NOT REGULATED

IATA

NOT REGULATED

IMDG

NOT REGULATED

15. Regulatory Information

15.1. International Inventories

TSCA	Complies
DSL/NDSL	Complies
ENCS	Does not comply
IECSC	Does not comply
KECL	Complies
PICCS	Does not comply
AICS	Complies

Legend:

- TSCA - United States Toxic Substances Control Act Section 8(b) Inventory
- DSL/NDSL - Canadian Domestic Substances List/Non-Domestic Substances List
- ENCS - Japan Existing and New Chemical Substances
- IECSC - China Inventory of Existing Chemical Substances
- KECL - Korean Existing and Evaluated Chemical Substances
- PICCS - Philippines Inventory of Chemicals and Chemical Substances
- AICS - Australian Inventory of Chemical Substances

15.2. US Federal Regulations

SARA 313

Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 (SARA). This product contains a chemical or chemicals which are subject to the reporting requirements of the Act and Title 40 of the Code of Federal Regulations, Part 372

Chemical name	SARA 313 - Threshold Values %
2-(2-Butoxyethoxy)ethanol - 112-34-5	1.0

SARA 311/312 Hazard Categories

Acute Health Hazard Yes



Product code 068122

Product name Ansulite AFC-5A / 3% AFFF

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Chronic health hazard	No
Fire Hazard	No
Sudden Release of Pressure Hazard	No
Reactive Hazard	No

CWA (Clean Water Act)

This product does not contain any substances regulated as pollutants pursuant to the Clean Water Act (40 CFR 122.21 and 40 CFR 122.42)

CERCLA

This material, as supplied, does not contain any substances regulated as hazardous substances under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302) or the Superfund Amendments and Reauthorization Act (SARA) (40 CFR 355). There may be specific reporting requirements at the local, regional, or state level pertaining to releases of this material

15.3. US State Regulations

U.S. State Right-to-Know Regulations

Chemical name	New Jersey	Massachusetts	Pennsylvania
2-(2-Butoxyethoxy)ethanol 112-34-5	X	-	X
2-Methyl-2,4-pentanediol 107-41-5	X	X	X
t-Butanol 75-65-0	X	X	X

16. Other information, including date of preparation of the last revision

NFPA	Health Hazards 0	Flammability 1	Instability 0	Physical and chemical properties -
HMIS	Health Hazards 0	Flammability 1	Physical Hazards 0	Personal Protection X

Revision date 02-Mar-2017

Revision note SDS sections updated, 3.

Disclaimer

The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.

End of Safety Data Sheet

Safety Data Sheet

This safety data sheet complies with the requirements of: 2012 OSHA Hazard Communication Standard (29CFR 1910.1200)

Product name CHEMGUARD 3% AFFF C306-MS-C

1. Identification

1.1. Product Identifier

Product name CHEMGUARD 3% AFFF C306-MS-C

1.2. Other means of identification

Product code 770810
Synonyms None
Chemical Family No information available

1.3. Recommended use of the chemical and restrictions on use

Recommended use Fire extinguishing agent.
Uses advised against Consumer use.

1.4. Details of the Supplier of the Safety Data Sheet

Company Name Tyco Fire Protection Products
One Stanton Street
Marinette, WI 54143-2542
Telephone: 715-735-7411
Product Stewardship at 1-715-735-7411
Contact point psra@tycofp.com
E-mail address

1.5. Emergency Telephone Number

Emergency telephone CHEMTREC 800-424-9300 or 703-527-3887

2. Hazards Identification

Classification

This chemical is considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200)

Serious eye damage/eye irritation - Category 1
Skin Sensitization - Category 1B

2.2. Label Elements

Signal Word
DANGER

Hazard Statements

Causes serious eye damage
May cause an allergic skin reaction



Precautionary Statements

Prevention

Wear protective gloves/protective clothing/eye protection/face protection. Avoid breathing dust/fume/gas/mist/vapors/spray. Contaminated work clothing should not be allowed out of the workplace.

IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a POISON CENTER or doctor/physician.

IF ON SKIN: Wash with plenty of soap and water. If skin irritation or rash occurs: Get medical advice/attention. Wash contaminated clothing before reuse.

Disposal

Dispose of contents/container to an approved waste disposal plant.

2.3. Hazards Not Otherwise Classified (HNOC)

Not Applicable.

2.4. Other Information

Unknown Acute Toxicity 28.333% of the mixture consists of ingredient(s) of unknown toxicity

3. Composition/information on Ingredients**3.1. Mixture**

The following component(s) in this product are considered hazardous under applicable OSHA(USA)

Chemical name	CAS No.	weight-%
2-(2-Butoxyethoxy)ethanol	112-34-5	10 - 30
Laurylamidopropyl betaine	4292-10-8	1 - 5
Caprylcaprylyl glucoside	68515-73-1	1 - 5
Polyfluorinated alkyl polyamide	Proprietary	1 - 5
Octylphenoxypolyethoxyethanol	9036-19-5	1 - 5
Polyfluorinated alkyl quaternary amine chloride	Proprietary	0.1 - 1

4. First aid measures**4.1. Description of first aid measures**

Eye Contact	Rinse thoroughly with plenty of water for at least 15 minutes, lifting lower and upper eyelids. Consult a physician.
Skin contact	Wash skin with soap and water. Get medical attention if irritation develops and persists.
Inhalation	Remove to fresh air. If breathing is difficult, give oxygen. (Get medical attention immediately if symptoms occur.)
Ingestion	Rinse mouth. Do not induce vomiting without medical advice. If swallowed, call a poison control center or physician immediately.

4.2. Most Important Symptoms and Effects, Both Acute and Delayed

Symptoms No information available.

4.3. Indication of Any Immediate Medical Attention and Special Treatment Needed

Note to physicians Treat symptomatically.

5. Fire-fighting measures

5.1. Suitable Extinguishing Media

Product is extinguishing agent. Use extinguishing measures that are appropriate to local circumstances and the surrounding environment.

5.2. Unsuitable Extinguishing Media

None.

5.3. Specific Hazards Arising from the Chemical

None known.

Hazardous Combustion Products

Carbon oxides, Fluorinated oxides, Nitrogen oxides (NOx), Oxides of sulfur

5.4. Explosion Data

Sensitivity to Mechanical Impact None.

Sensitivity to Static Discharge None.

5.5. Protective Equipment and Precautions for Firefighters

As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

6. Accidental release measures**6.1. Personal precautions, protective equipment and emergency procedures****Personal Precautions**

Ensure adequate ventilation, especially in confined areas.

For emergency responders

Use personal protection recommended in Section 8.

6.2. Environmental Precautions**Environmental Precautions**

Prevent further leakage or spillage if safe to do so. Prevent entry into waterways, sewers, basements or confined areas. See Section 12 for additional Ecological Information.

6.3. Methods and material for containment and cleaning up**Methods for Containment**

Prevent further leakage or spillage if safe to do so.

Methods for Cleaning Up

Pick up and transfer to properly labeled containers.

7. Handling and Storage**7.1. Precautions for Safe Handling****Advice on safe handling**

Avoid contact with skin and eyes. Handle in accordance with good industrial hygiene and safety practice.

7.2. Conditions for safe storage, including any incompatibilities**Storage Conditions**

Keep containers tightly closed in a dry, cool and well-ventilated place.

Incompatible Materials

Strong oxidizing agents. Strong acids. Strong bases.

8. Exposure Controls/Personal Protection**8.1. Control Parameters****Exposure guidelines**

Chemical name	ACGIH TLV	OSHA PEL	NIOSH IDLH	Mexico OEL
2-(2-Butoxyethoxy)ethanol 112-34-5	TWA: 10 ppm inhalable fraction and vapor	-	-	-

ACGIH (American Conference of Governmental Industrial Hygienists) OSHA (Occupational Safety and Health Administration of the US Department of Labor) NIOSH IDLH Immediately Dangerous to Life or Health

8.2. Appropriate Engineering Controls

Engineering controls	Showers Eyewash stations Ventilation systems.
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8.3. Individual protection measures, such as personal protective equipment

Eye/Face Protection	Avoid contact with eyes. Tight sealing safety goggles.
Skin and Body Protection	Wear protective gloves and protective clothing.
Respiratory Protection	If exposure limits are exceeded or irritation is experienced, NIOSH/MSHA approved respiratory protection should be worn. Positive-pressure supplied air respirators may be required for high airborne contaminant concentrations. Respiratory protection must be provided in accordance with current local regulations.
Ventilation	Use local exhaust or general dilution ventilation to control exposure with applicable limits

8.4. General hygiene considerations

Do not eat, drink or smoke when using this product. Handle in accordance with good industrial hygiene and safety practice.

9. Physical and Chemical Properties**9.1. Information on basic physical and chemical properties**

Physical State	Liquid	Color	Light yellow
Odor	Characteristic		
Odor Threshold	No data available		
Property	Values	Remarks • Method	
pH	7- 8.5		
Melting point/freezing point	No data available		
Boiling point / boiling range	No data available		
Flash Point	No data available		
Evaporation Rate	No data available		
Flammability (solid, gas)	No data available		
Flammability limit in air			
Upper flammability limit:	No data available		
Lower flammability limit:	No data available		
Vapor Pressure	No data available		
Vapor Density	No data available		
Specific gravity	No data available		
Water Solubility	No data available		
Solubility in Other Solvents	No data available		

Partition coefficient No data available
Autoignition Temperature No data available
Decomposition Temperature No data available
Kinematic viscosity No data available

Density 1.02

10. Stability and Reactivity

10.1. Chemical Stability

Stable under recommended storage conditions.

10.2. Reactivity

No data available

10.3. Possibility of hazardous reactions

None under normal processing.

Hazardous Polymerization Hazardous polymerization does not occur.

10.4. Conditions to Avoid

Extremes of temperature and direct sunlight.

10.5. Incompatible Materials

Strong oxidizing agents. Strong acids. Strong bases.

10.6. Hazardous decomposition products

Carbon oxides. Nitrogen oxides (NOx). Oxides of sulfur. Fluorinated oxides.

11. Toxicological Information

11.1. Information on Likely Routes of Exposure

Product information

Inhalation No data available.
Eye Contact Corrosive to the eyes and may cause severe damage including blindness.
Skin contact May cause allergic skin reaction.
Ingestion No data available.

Component Information

Acute Toxicity

Chemical name	Oral LD50	Dermal LD50	Inhalation LC50
2-(2-Butoxyethoxy)ethanol 112-34-5	= 5660 mg/kg (Rat)	= 2700 mg/kg (Rabbit)	-
Laurylamidopropyl betaine 4292-10-8	> 2000 mg/kg (Rat)	-	-
Polyfluorinated alkyl polyamide	>2000 mg/kg	>2000 mg/kg	>5.11 mg/l
Octylphenoxypolyethoxyethanol	= 1700 mg/kg (Rat) = 4190 mg/kg	-	-

9036-19-5	(Rat)		
Polyfluorinated alkyl quaternary amine chloride	>300 - <2000 mg/kg	-	-

11.2. Information on Toxicological Effects

Symptoms No information available.

11.3. Delayed and immediate effects as well as chronic effects from short and long-term exposure

Skin Corrosion/Irritation No information available.
Serious eye damage/eye irritation Risk of serious damage to eyes.
Sensitization May cause sensitization by skin contact.
Germ Cell Mutagenicity No information available.
Carcinogenicity No information available.
Reproductive Toxicity No information available.
STOT - Single Exposure No information available.
STOT - Repeated Exposure No information available.
Aspiration Hazard No information available.

11.4. Numerical Measures of Toxicity - Product information

The following values are calculated based on chapter 3.1 of the GHS document

ATEmix (oral) 11648 mg/kg
ATEmix (dermal) 12061 mg/kg
ATEmix (inhalation-dust/mist) 223.9 mg/l

12. Ecological Information

12.1. Ecotoxicity

0.1011% of the mixture consists of component(s) of unknown hazards to the aquatic environment

Chemical name	Algae/aquatic plants	Fish	Crustacea
2-(2-Butoxyethoxy)ethanol 112-34-5	EC50 (96h) > 100 mg/L Desmodesmus subspicatus	LC50 (96h) static = 1300 mg/L Lepomis macrochirus	EC50 (48h) > 100 mg/L Daphnia magna EC50 (24h) = 2850 mg/L Daphnia magna
2-Methyl-2,4-pentanediol 107-41-5	-	LC50 (96h) flow-through = 8690 mg/L Pimephales promelas LC50 (96h) flow-through 10500 - 11000 mg/L Pimephales promelas LC50 (96h) static = 10000 mg/L Lepomis macrochirus LC50 (96h) static = 10700 mg/L Pimephales promelas	EC50 (48h) 2700 - 3700 mg/L Daphnia magna
t-Butanol 75-65-0	EC50 (72h) > 1000 mg/L Desmodesmus subspicatus	LC50 (96h) flow-through 6130 - 6700 mg/L Pimephales promelas	EC50 (48h) Static 4607 - 6577 mg/L Daphnia magna EC50 (48h) = 933 mg/L Daphnia magna
Polyethylene Glycol 25322-68-3	-	LC50 (24h) > 5000 mg/L Carassius auratus	-
Sodium chloride 7647-14-5	-	LC50 (96h) semi-static = 7050 mg/L Pimephales promelas LC50 (96h) flow-through 4747 - 7824 mg/L Oncorhynchus mykiss LC50 (96h) static = 12946 mg/L Lepomis macrochirus LC50 (96h) static 6020 - 7070 mg/L Pimephales promelas LC50 (96h) flow-through 5560 - 6080 mg/L Lepomis macrochirus LC50 (96h) static 6420 - 6700 mg/L Pimephales promelas	EC50 (48h) Static 340.7 - 469.2 mg/L Daphnia magna EC50 (48h) = 1000 mg/L Daphnia magna
4,4'-bis-(sulfostyryl)-biphenyl disodium salt	EC50 (72h) = 10 mg/L Desmodesmus subspicatus EC50	LC50 (96h) static = 76 mg/L Brachydanio rerio	EC50 (48h) = 1000 mg/L Daphnia magna

27344-41-8	(96h) 10.0 - 11.0 mg/L Desmodosmus subspicatus		
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Polyfluorinated alkyl polyamide					
Method	Species	Endpoint type	Effective dose	Exposure time	Results
OECD Test No. 203: Fish, Acute Toxicity Test	Oncorhynchus mykiss (rainbow trout)	LC50	>14 mg/l	96h	NOEC: 14 mg/L No toxic effects at saturation.
OECD Test No. 201: Freshwater Alga and Cyanobacteria, Growth Inhibition Test	Algae	ErC50	>15 mg/l	72h	Growth rate >15, Yield 13. NOEC: 4.0 mg/L, LOEC: 8.5 mg/L
OECD Test No. 202: Daphnia sp., Acute Immobilization Test	Daphnia magna	EC50	>20 mg/l	48h	NOEC: 20 mg/L No toxic effects at saturation.

12.2. Persistence and Degradability

No information available.

12.3. Bioaccumulation

No information available.

12.4. Other Adverse Effects

No information available

13. Disposal Considerations**13.1. Waste Treatment Methods****Disposal of wastes**

Disposal should be in accordance with applicable regional, national and local laws and regulations.

Contaminated Packaging

Do not reuse container.

14. Transport Information

DOT	NOT REGULATED
TDG	NOT REGULATED
MEX	NOT REGULATED
ICAO (air)	NOT REGULATED
IATA	NOT REGULATED
IMDG	NOT REGULATED

15. Regulatory Information**15.1. International Inventories**

TSCA	Complies
DSL/NDSL	Does not comply



Product code 770810

Product name CHEMGUARD 3% /
AFFF C306-MS-C

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ENCS	Does not comply
IECSC	Does not comply
KECL	Does not comply
PICCS	Does not comply
AICS	Does not comply

Legend:

TSCA - United States Toxic Substances Control Act Section 8(b) Inventory
 DSL/NDSL - Canadian Domestic Substances List/Non-Domestic Substances List
 ENCS - Japan Existing and New Chemical Substances
 IECSC - China Inventory of Existing Chemical Substances
 KECL - Korean Existing and Evaluated Chemical Substances
 PICCS - Philippines Inventory of Chemicals and Chemical Substances
 AICS - Australian Inventory of Chemical Substances

15.2. US Federal Regulations

SARA 313

Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 (SARA). This product contains a chemical or chemicals which are subject to the reporting requirements of the Act and Title 40 of the Code of Federal Regulations, Part 372

Chemical name	SARA 313 - Threshold Values %
2-(2-Butoxyethoxy)ethanol - 112-34-5	1.0

SARA 311/312 Hazard Categories

Acute Health Hazard	Yes
Chronic health hazard	No
Fire Hazard	No
Sudden Release of Pressure Hazard	No
Reactive Hazard	No

CWA (Clean Water Act)

This product does not contain any substances regulated as pollutants pursuant to the Clean Water Act (40 CFR 122.21 and 40 CFR 122.42)

CERCLA

This material, as supplied, does not contain any substances regulated as hazardous substances under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302) or the Superfund Amendments and Reauthorization Act (SARA) (40 CFR 355). There may be specific reporting requirements at the local, regional, or state level pertaining to releases of this material

15.3. US State Regulations

U.S. State Right-to-Know Regulations

Chemical name	New Jersey	Massachusetts	Pennsylvania
2-(2-Butoxyethoxy)ethanol 112-34-5	X	-	X

16. Other information, including date of preparation of the last revision

NFPA	Health Hazards 2	Flammability 0	Instability 0	Physical and chemical properties - Personal Protection X
HMIS	Health Hazards 2	Flammability 0	Physical Hazards 0	

Revision date 10-Apr-2017

Revision note SDS sections updated, 2, 11, 12.

Disclaimer

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End of Safety Data Sheet

CHEMGUARD C306-MS 3% AFFF Concentrate

Description

CHEMGUARD C306-MS 3% AFFF (Aqueous Film-Forming Foam) Concentrate combines fluoro- and hydrocarbon-surfactant technology to provide superior fire and vapor suppression for Class B hydrocarbon fuel fires. This synthetic foam concentrate is intended for firefighting applications at 3% solution in fresh, salt, or hard water.

CHEMGUARD C306-MS foam solution utilizes three suppression mechanisms for rapid fire knockdown and enhanced burnback resistance:

- The foam blanket blocks oxygen supply to the fuel.
- Liquid drains from the foam blanket and forms an aqueous film that suppresses fuel vapor and seals the fuel surface.
- The water content of the foam solution produces a cooling effect for additional fire suppression.

TYPICAL PHYSIOCHEMICAL PROPERTIES AT 77 °F (25 °C)

Appearance	Pale yellow liquid
Density	1.02 ± 0.02 g/ml
pH	7.0 – 8.5
Refractive Index	1.3655 ± 0.0020
Viscosity	3.25 ± 1.0 cSt*
Spreading Coefficient	3.0 minimum at 3%
Pour Point	27 °F (-3 °C)
Freeze Point	27 °F (-3 °C)

*Cannon Fenske viscometer at 25 °C

Application

CHEMGUARD C306-MS 3% AFFF Concentrate is intended for use on Class B hydrocarbon fuel fires having low water solubility such as crude oils, gasolines, diesel fuels, and aviation fuels. It is not suitable for use on polar fuels having appreciable water solubility, such as methyl and ethyl alcohol, acetone, and methyl ethyl ketone.

The concentrate has excellent wetting properties that can effectively combat Class A fires as well. It may also be used in conjunction with dry chemical agents to provide even greater fire suppression performance.

CHEMGUARD C306-MS Concentrate is ideal for fixed and emergency response firefighting systems designed to protect naval and aviation assets. Typical applications include:

- Military and civilian aircraft facilities
- Crash fire rescue (per US DOT FAA AC No. 150/5210-6D)
- On-board marine/naval fire suppression systems
- Storage tanks
- Docks/marine tankers



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Approvals, Listings, and Standards

CHEMGUARD C306-MS 3% AFFF Concentrate is approved, listed, qualified under, or meets the requirements of the following specifications and standards:

- US Department of Defense Military Specification
 - MIL-F-24385F: Fire Extinguishing Agent, Aqueous Film-Forming Foam (AFFF) Liquid Concentrate for Fresh and Sea Water.
- Underwriters Laboratories Inc. (UL)
 - UL Standard 162, Foam Liquid Concentrates
 - Fresh and Sea Water
- National Fire Protection Association (NFPA)
 - NFPA 403, Standard for Aircraft Rescue and Fire-Fighting Services at Airports
 - NFPA 409, Standard on Aircraft Hangars
 - NFPA 412, Standard for Evaluating Aircraft Rescue and Fire-Fighting Foam Fire Equipment
 - NFPA 414, Standard for Aircraft Rescue and Fire-Fighting Vehicles
 - NFPA 418, Standard for Heliports

Please contact Tyco Fire Protection Products Technical Services and/or refer to listing agency for current product and compatible hardware listings.

The environmentally-mindful CHEMGUARD C306-MS Concentrate formulation contains short-chain, C-6 fluorochemicals manufactured using a telomer-based process. The telomer process produces no PFOS, and these C-6 materials do not breakdown to yield PFOA. The fluorochemicals used in the concentrate meet the goals of the U.S. Environmental Protection Agency 2010/15 PFOA Stewardship Program.



Foaming Properties

CHEMGUARD C306-MS 3% AFFF Concentrate may be effectively applied using most conventional foam discharge equipment 3% dilution with fresh, salt, or hard water. For optimum performance, water hardness should not exceed 500 ppm expressed as calcium and magnesium.

Because of the low energy required to create foam with CHEMGUARD C306-MS Concentrate, the foam solution may be applied with aspirating and non-aspirating discharge devices. Aspirating discharge devices typically produce expansion ratios from 3.5:1 to 10:1, depending on the type of device and the flow rate. Non-aspirating devices, such as handline water fog/stream nozzles or standard sprinkler heads, typically produce expansion ratios from 2:1 to 4:1. Medium-expansion discharge devices typically produce expansion ratios from 20:1 to 60:1.

TYPICAL FOAM CHARACTERISTICS** (Fresh and Sea Water)

Proportioning Rate	3%
Expansion Ratio LE	9.5
25% Drain Time (min:sec)	3:30
50% Drain Time (min:sec)	5:45

**per EN 1568-3, 2008 protocol

Proportioning

CHEMGUARD C306-MS 3% AFFF Concentrate can be correctly proportioned using most conventional, properly calibrated, in-line proportioning equipment such as:

- Balanced and in-line balanced pressure pump proportioners
- Balanced pressure bladder tanks and ratio flow controllers
- Around-the-pump type proportioners
 - Fixed or portable in-line venturi type proportioners
- Handline nozzles with fixed eductor/pick-up tubes

For immediate use: The concentrate may also be diluted with fresh or sea water to a 3% pre-mix solution.

For delayed use: Consult Technical Services for guidance regarding suitability of a pre-mix solution (fresh water only).

Materials of Construction Compatibility

CHEMGUARD C306-MS Concentrate compatibility with HDPE has been successfully evaluated using ASTM D1693-70 protocol under UL-162 standard. Concentrate corrosion studies with cold-rolled carbon steel (UNS G10100), 90-10 copper-nickel (UNS C70600), 70-30 nickel-copper (UNS N04400), bronze (UNS C90500), and CRES steel (UNS S30400) have been successfully completed per ASTM E527 protocol under MIL-F-24385F specification.

To avoid corrosion, galvanized pipe and fittings should never be used in contact with undiluted concentrate. Please refer to Technical Bulletin No. 59 for recommendations and guidance regarding compatibility of CHEMGUARD concentrates with common materials of construction in the firefighting foam industry.

Storage and Handling

CHEMGUARD C306-MS 3% AFFF Concentrate should be stored in the original supplied package (HDPE totes, drums, or pails) or in the foam system equipment recommended by Technical Services. The product should be maintained within the recommended 35°F to 120°F (2°C to 49°C) operational temperature range. If the concentrate freezes during transport or storage, full product serviceability can be restored upon thaw with gentle re-mixing.

Factors affecting the foam concentrate long-term effectiveness include temperature exposure and cycling, storage container, air exposure, evaporation, dilution, and contamination. The effective life of CHEMGUARD C306-MS Concentrate can be maximized through optimal storage conditions and proper handling.

CHEMGUARD foam concentrates have demonstrated effective firefighting performance with contents stored in the original package under proper conditions for more than 10 years.

CHEMGUARD C306-MS 3% AFFF Concentrate has been successfully evaluated by the US Naval Sea Systems Command for prolonged compatibility with other 3% AFFF concentrates qualified under MIL-F-24385F specification.

- Mixing with foam concentrates not vetted by MIL-F-24385F is not recommended.
- For immediate incident response, it is appropriate to use the concentrate in conjunction with comparable 3% AFFF products.

Inspection

CHEMGUARD C306-MS 3% AFFF Concentrate should be inspected periodically per NFPA 11 "Standard for Low-, Medium-, and High-Expansion Foam," EN 13565-2 "Foam System Standard," or other relevant standard. A representative concentrate sample should be sent to Tyco Fire Protection Products Foam Analytical Services or other qualified laboratory for quality analysis per the applicable standard. An annual inspection and sample analysis is typically sufficient, unless the product has been exposed to unusual conditions.

Ordering Information

Concentrate is available in commercial packaging only under CHEMGUARD C306-MS-C product designation and is not available for direct, contract government acquisition (per MIL-F-24385F packaging provision). Concentrate is available in pails, drums, totes or bulk shipment, with pail and drum containers being UL-162 compliant.

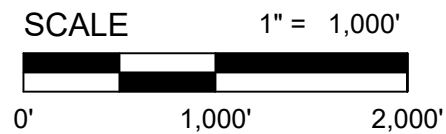
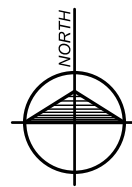
Part No.	Description	Shipping Weight	Cube
770809	Pail 5 gal (19 L)	45 lb (20.4 kg)	1.25 ft ³ (0.0353 m ³)
770810	Drum 55 gal (208 L)	495 lb (224.5 kg)	11.83 ft ³ (0.3350 m ³)
770811	Tote 265 gal (1000 L)	2463 lb (1117 kg)	50.05 ft ³ (1.42 m ³)

Safety Data Sheet (SDS) available at www.chemguard.com

Note: The converted metric values in this document are provided for dimensional reference only and do not reflect an actual measurement.

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LOCATION DESCRIPTION		CAUSE FOR INTEREST
1	NE End of Runway 18	Historic testing location for firefighting equipment; Known foam discharge area.
2	Maintenance Hangar	Aircraft maintenance area, Hydraulic fluid use and storage area; Potential discharge area.
3	Former Fire Department & Maintenance Area	Previous storage and testing location for AFFF and firefighting equipment; Known foam discharge area.
4	Current Fire Department	Current storage and testing location for AFFF and firefighting equipment; Known foam discharge area.
5	South End of Runway 36	Historic disposal site; Potential discharge area.

Location:

City of Traverse City
 PART OF T27N, R10W, AND T27N, R11W
 GARFIELD & EAST BAY TOWNSHIPS,
 GRAND TRAVERSE COUNTY, MICHIGAN

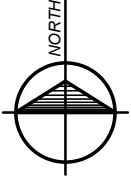
Sheet 1 of Att 2.

Areas of Interest
TVC PFAS Assessment
 Northwest Regional Airport Commission

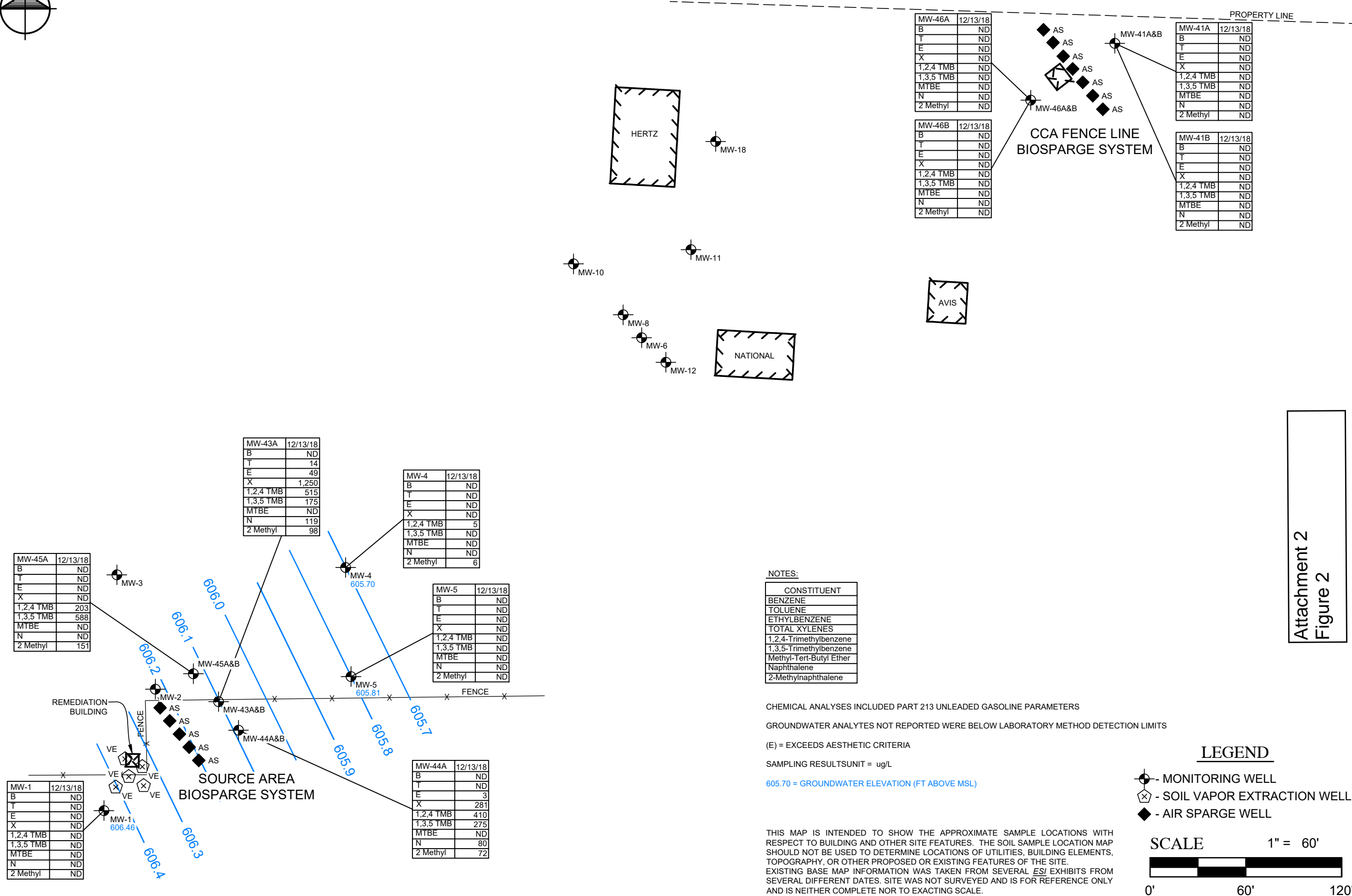
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 Drawn: AES
 Chk'd.:
 Rev.:



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 CIVIL ENGINEERING | SURVEYING | ENVIRONMENTAL SERVICES | GEOTECHNICAL
 CONSTRUCTION SERVICES | DRILLING | LANDSCAPE ARCHITECTURE



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MW-45A	12/13/18
B	ND
T	ND
E	ND
X	ND
1,2,4 TMB	203
1,3,5 TMB	588
MTBE	ND
N	ND
2 Methyl	151

MW-1	12/13/18
B	ND
T	ND
E	ND
X	ND
1,2,4 TMB	ND
1,3,5 TMB	ND
MTBE	ND
N	ND
2 Methyl	ND

MW-43A	12/13/18
B	ND
T	14
E	49
X	1,250
1,2,4 TMB	515
1,3,5 TMB	175
MTBE	ND
N	119
2 Methyl	98

MW-4	12/13/18
B	ND
T	ND
E	ND
X	ND
1,2,4 TMB	5
1,3,5 TMB	ND
MTBE	ND
N	ND
2 Methyl	6

MW-5	12/13/18
B	ND
T	ND
E	ND
X	ND
1,2,4 TMB	ND
1,3,5 TMB	ND
MTBE	ND
N	ND
2 Methyl	ND

MW-44A	12/13/18
B	ND
T	ND
E	3
X	281
1,2,4 TMB	410
1,3,5 TMB	275
MTBE	ND
N	80
2 Methyl	72

MW-46A	12/13/18
B	ND
T	ND
E	ND
X	ND
1,2,4 TMB	ND
1,3,5 TMB	ND
MTBE	ND
N	ND
2 Methyl	ND

MW-46B	12/13/18
B	ND
T	ND
E	ND
X	ND
1,2,4 TMB	ND
1,3,5 TMB	ND
MTBE	ND
N	ND
2 Methyl	ND

MW-41A	12/13/18
B	ND
T	ND
E	ND
X	ND
1,2,4 TMB	ND
1,3,5 TMB	ND
MTBE	ND
N	ND
2 Methyl	ND

MW-41B	12/13/18
B	ND
T	ND
E	ND
X	ND
1,2,4 TMB	ND
1,3,5 TMB	ND
MTBE	ND
N	ND
2 Methyl	ND

NOTES:

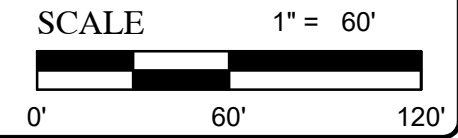
CONSTITUENT
BENZENE
TOLUENE
ETHYLBENZENE
TOTAL XYLENES
1,2,4-Trimethylbenzene
1,3,5-Trimethylbenzene
Methyl-Tert-Butyl Ether
Naphthalene
2-Methylnaphthalene

CHEMICAL ANALYSES INCLUDED PART 213 UNLEADED GASOLINE PARAMETERS
 GROUNDWATER ANALYTES NOT REPORTED WERE BELOW LABORATORY METHOD DETECTION LIMITS
 (E) = EXCEEDS AESTHETIC CRITERIA
 SAMPLING RESULTSUNIT = ug/L
 605.70 = GROUNDWATER ELEVATION (FT ABOVE MSL)

THIS MAP IS INTENDED TO SHOW THE APPROXIMATE SAMPLE LOCATIONS WITH RESPECT TO BUILDING AND OTHER SITE FEATURES. THE SOIL SAMPLE LOCATION MAP SHOULD NOT BE USED TO DETERMINE LOCATIONS OF UTILITIES, BUILDING ELEMENTS, TOPOGRAPHY, OR OTHER PROPOSED OR EXISTING FEATURES OF THE SITE. EXISTING BASE MAP INFORMATION WAS TAKEN FROM SEVERAL *ESI* EXHIBITS FROM SEVERAL DIFFERENT DATES. SITE WAS NOT SURVEYED AND IS FOR REFERENCE ONLY AND IS NEITHER COMPLETE NOR TO EXACTING SCALE.

LEGEND

- MONITORING WELL
- SOIL VAPOR EXTRACTION WELL
- AIR SPARGE WELL



Attachment 2
Figure 2

Gosling Czubak
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 Fax: 231-941-4603

- Engineers
- Surveyors
- Environmental Services
- Landscape Architecture

Job #: 2015630.01
 Date: 06/30/2015
 Scale: 1" = 60'
 Drawn: jrl
 Chkd.: DGC
 Rev.: 03/01/2019

**Groundwater Sampling Results
 December 13, 2018
 Cherry Capitol Airport**

Location: PART OF SECTION 13,
 T 27 N, R 11 W,
 GRAND TRAVERSE COUNTY,
 TRAVERSE CITY, MICHIGAN
 Sheet 1 of 1

Layers Tool Map Tools Data Search

GeoWebFace Map GeoWebFace Results

Zoom In Zoom Out Pan Clear Zoom Extents Map Nav Info Identify

Private water wells as reported by Wellogic

GeoWebFace Layers

Toggle layer visibility by clicking the corresponding checkbox. Activate the transparency slider for a layer by clicking on the transparency slider.

- Oil and Gas Information
- Mining and Minerals
- Geology
 - Michigan Watersheds
 - Great Lakes Watershed
 - Wellogic Type I Water Wells
 - Wellogic Type II Water Wells
 - Wellogic Water Wells
 - Wellhead Protection Areas
 - Traditional Wellhead Protection Area Delineat
 - Type 1 Provisional Wellhead Protection Area
 - Type 2 Provisional Wellhead Protection Area
 - Low Vulnerability Wellhead Area
 - Scanned Water Well Logs by Sector
 - Staff Gages USGS
 - 100k Topographic Contours
 - Quaternary Geology Features
 - Glacial Lobe Boundaries
 - Quaternary Directional Indicators
 - End Moraine and Ice Contact Outwa
 - Quaternary Geology
 - Part 303 Final Wetlands Inventory
 - MNFI Landcover, Circa 1800
 - Waterfalls
 - Outcrops and Thin Drift



Attachment 2
Figure 3

Attachment 3

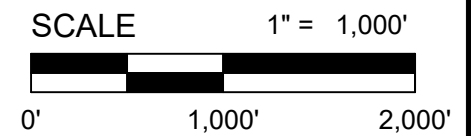
Proposed Assessment Locations

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LEGEND

- EXISTING MONITORING WELL LOCATION
- PROPOSED MONITORING WELL LOCATION
- PROPOSED SOIL SAMPLING LOCATION
- PROPOSED STORM WATER SAMPLING LOCATION



**Proposed Sampling Locations
TVC PFAS Assessment
Northwest Regional Airport Commission**

Location:
City of Traverse City
PART OF T27N, R10W, AND T27N, R11W
GARFIELD & EAST BAY TOWNSHIPS,
GRAND TRAVERSE COUNTY, MICHIGAN
Sheet 1 of Att. 3

Job #: 2020630001
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Attachment 4

Quality Assurance Project Plan



Introduction

Gosling Czubak Engineering Sciences, Inc. (Gosling Czubak, GCES) will be conducting investigation, sampling, and reporting of Per- and Polyfluoroalkyl Substances (PFAS) in multiple media at Cherry Capital Airport, Traverse City, Michigan. The project is being completed to determine if PFAS contamination is present at five areas of interest at the airport. This Quality Assurance Project Plan (QAPP) provides a brief background and outlines the procedures that will be used to assure precise, accurate, and consistent collection of environmental data and reporting for this project.

Personnel

Gosling Czubak personnel will perform assessment activities for the project. GCES personnel have collected numerous samples of various media for PFAS analysis. Quality assurance/quality control samples consistently meet project objectives with equipment and field blank PFAS analytical results typically below quantification limits. Gosling Czubak has formed a project team consisting of the project manager, project personnel, and field sampling technicians to collaborate on site-specific sampling plans, review sampling objectives, identify potential sources of cross-contamination, and quality assurance (QA)/quality control (QC) procedures for the site.

Sampling Protocols

All sampling protocols will follow the EGLE/MPART sampling guidance documents and Gosling Czubak's PFAS Sampling Procedures Document (attached). In the case of a discrepancy between documents, the MPART sampling guidance documents shall take precedence. Groundwater samples will be collected utilizing low-flow sampling methods. All sample-contacting equipment shall be fluoropolymer (PFAS)-free. Assessment activities shall begin at less impacted areas and proceed to more impacted areas.

Laboratory Analysis

Laboratory analysis will be completed by Pace Analytical Services, LLC. Pace will provide a Level II laboratory report for the twenty-eight PFAS compounds identified on the EGLE PFAS minimum laboratory analyte list. All samples will be analyzed by a modified USEPA Method 537 with isotope dilution.

PFAS Sampling Procedures Document

Investigation and Sampling

Gosling Czubak Engineering Sciences, Inc.

Traverse City, Michigan

March 2019

Updated May 2020

Gosling Czubak Engineering Sciences, Inc.

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Traverse City, Michigan

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APPENDICES

Appendix A: MDEQ PFAS Sampling Quick Reference Field Guidance

Appendix B: MDEQ Groundwater PFAS Sampling Guidance

Appendix C: EGLE For Technical Staff and Contractors – Residential Well PFAS Sampling Guidance

Appendix D: MDEQ Wastewater PFAS Sampling Guidance

Appendix E: MDEQ Soil PFAS Sampling Guidance

Appendix F: MDEQ Surface Water PFAS Sampling Guidance

1.0 INTRODUCTION

This document describes the Per- and Polyfluoroalkyl Substances (PFAS) sampling procedures for Gosling Czubak Engineering Sciences, Inc. (Gosling Czubak). The purpose of this document is to define the procedures used for accurate and consistent collection of environmental data for this emerging contaminant. The plan is used as a training aid and reference for company personnel.

As PFAS is an emerging contaminant, Gosling Czubak will frequently review and revise the quality assurance/quality control (QA/QC) Plan in order to remain current with fast-changing environmental procedures, laws, and technology. The QA/QC procedures outlined below are based on information from the following Michigan Department of Environment, Great Lakes, and Energy (EGLE) (f.k.a Michigan Department of Environmental Quality {MDEQ}), the Interstate Technology Regulator Council (ITRC), and United States Environmental Protection Agency (USEPA) guidance documents.

- MDEQ – General PFAS Sampling Guidance, Rev. 10/16/2018;
- ITRC Fact Sheet – Site Characterization Considerations, Sampling Precautions, and Laboratory Analytical Methods for Per- and Polyfluoroalkyl Substances (PFAS), April 2020; and
- USEPA Technical Brief – PFAS methods and guidance for sampling and analyzing water and other environmental media, updated January 2020.

2.0 BACKGROUND

2.1 PFAS Characteristics and Use

PFAS are a synthetic, fluorinated, organic group of chemicals used since the 1940s. There are more than 4,700 PFAS compounds identified to date, with new versions developed as others are discontinued. Depending on the certain PFAS compounds, varieties have different properties and can be surfactants, oil-repelling, water repelling, and water-soluble. PFAS are found in a wide array of consumer and industrial products due to their ability to resist temperature extremes, repel water, and reduce friction. The major sources of PFAS releases into the environment include firefighting foam (fire training facilities and fire suppression sites), PFAS manufacturing facilities, and other industrial/manufacturing facilities (especially electroplating, textile, and coating operations). Due to PFAS persistence in the natural and infrastructure environment, facilities such as wastewater treatment plants and landfills are under increased scrutiny as potential collateral sources of PFAS. Increasing the complexity of PFAS

evaluations, compounds are often transformed by abiotic and biotic processes. Due to their widespread use and persistence in the environment, most people in the United States have been exposed to PFAS, which is an extremely important point to consider when developing a sampling, analysis, and quality control plan for PFAS evaluations.

2.2 Current Regulatory Advisories

It is reported that evidence exists that continued exposure above specific levels to certain PFAS may lead to adverse health. Of the more than 4,700 PFAS compounds, only a few varieties have been studied enough for health advisories or criteria to be established at the state or national levels. The USEPA has issued a Lifetime Health Advisory of 70 nanogram per liter (ng/L) or parts per trillion (ppt) for PFAS compounds perfluorooctanoic acid (PFOA) or perfluorooctane sulfonate (PFOS), or in combination. The USEPA has not yet set maximum contaminant levels (MCL) for any PFAS under the Safe Drinking Water act. However, on December 3, 2019, USEPA sent the Office of Management and Budget a proposed regulatory determination for PFOA and PFOS for interagency review. After review, the proposal will be submitted for public comment.

EGLE has generic cleanup criteria for PFOA and PFOS of 70 ng/L (parts per trillion) in drinking water and groundwater, and surface water/effluent human noncancer values for PFOA and PFOS of 420 ng/L and 11 ng/L, respectively. In February 2020, the Michigan Environmental Rules Review Committee approved rules to regulate seven PFAS compounds. These PFAS compounds have individual MCL ranging from 6 – 400,000 ppt. The cleanup criteria values in the parts per trillion range is another important point to consider when developing a sampling, analysis, and quality control plan for PFAS evaluations.

3.0 SAMPLING OBJECTIVES AND PLANNING

PFAS sampling may be performed for a variety of purposes, including drinking water well screening, hydrogeological evaluations of potential sources, Part 115 landfill monitoring of groundwater or leachate, Part 22 groundwater discharge monitoring, and/or Part 31 surface water discharge monitoring. Therefore, it is imperative that client and laboratory representatives and Gosling Czubak's project team (consisting of the project manager, project scientists/geologists/engineers, and sampling technicians)

collaborate on site-specific sampling plans to review sampling objectives, identify potential sources of cross-contamination, and determine the best sampling, analysis, and QC practices for each facility. In some instances of differing well constructions and dedicating sampling equipment, a work plan may require a well by well sampling plan.

3.1 Potential Sources of Cross-Contamination

Potential sources of PFAS cross-contamination must be evaluated prior to field work and included in a site-specific PFAS sampling plan. The following should be evaluated for potential sources of PFAS:

- Source water;
- Sampling equipment pumps (including electrical connections/seals/check valves/tubing/etc.), meters, tooling;
- Sampler field clothing, personal protective equipment (PPE), sunscreen, insect repellent, personal hygiene/personal care products (PCP), and food packaging;
- Infrastructure or monitor/water well construction (piping/casing O-rings/packers/well seals); and,
- Site atmosphere/background influences.

Water Sources

Water used for decontamination or drilling purposes should be determined to be PFAS-free prior to commencing field activities. When sampling a water source for PFAS, consider the exact method the water will be used/accessed and sample using drinking water sampling procedures (Section 5.0).

PFAS-free water to be used for field blank and equipment blank QC samples should be obtained from the laboratory.

Sampling Equipment

Many products marketed to the groundwater sampling industry are known to contain PFAS. Therefore, it is imperative that the specific equipment to be used during the sampling process is identified during the work plan process and determined to be PFAS-free, preferably by an equipment blank or at least by positive materials identification.

Generally, bladder pumps with polyethylene bladders and HDPE (not Teflon) tubing should be considered for PFAS sampling due to their limited number of material/parts. Certain submersible pumps can be used as well. Equipment blanks are to be collected from each piece of sampling equipment that is exposed to the groundwater or sample. Sample pumps should be tested by collecting an equipment blank from the discharge prior to each groundwater sample. In some cases, these samples may be held by the laboratory pending result of the environmental sample.

The following materials (and potential component locations) are known to contain PFAS and are **not** to be used:

- Polytetrafluoroethylene (PTFE), including Teflon® and Hostaflon®, can be found in many items, including ball check-valves on bailers, tubing/hose lining, wiring, gears, friction surfaces, and lubricant.
- Polyvinylidene fluoride (PVDF), including Kynar®, can be found in many items, including tubing, and coatings on aluminum, galvanized or aluminized steel, wire insulators, and lithium-ion batteries.
- Polychlorotrifluoroethylene (PCTFE), including Neoflon®, can be found in many items, including valves, seals, gaskets, and food packaging.
- Ethylene-tetrafluoro-ethylene (ETFE), including Tefzel®, can be found in many items, including wire and cable insulation/covers, roofing and siding, pipe liners, and cable zip/tie wraps.
- Fluorinated ethylene propylene (FEP), including Teflon® FEP and Hostaflon® FEP, and possibly Neoflon®, can be found in many items, including wire/cable insulation/covers, pipe linings, and labware.

It is important to note that some materials like low density polyethylene (LDPE) may not contain PFAS materials but may have been contaminated by PFAS in the manufacturing process and should be tested prior to use.

Additionally, even materials typically considered PFAS-free such as high-density polyethylene (HDPE), polypropylene, silicone, polyvinyl chloride (PVC), acetate, and bailer rope could be susceptible to PFAS contamination if not stored properly. Additional information regarding potential PFAS-containing equipment is included the MDEQ Quick Reference Field Guide in Appendix A.

Sampler Clothing, PPE, PCPs, and Food/Beverage

MDEQ sampling guidance prohibits sampling personnel from wearing new or unwashed clothing, Gore-Tex™-type or stain-resistant fabrics, or fabrics treated or recently washed in fabric softener, protectors, insect-resistant chemicals. Additional MDEQ guidance on specific materials or items that are allowable or that need screening/testing is included in Appendix A.

Infrastructure or Monitoring Well Construction

Site infrastructure (in the case of drinking water, leachate, or wastewater streams) and monitoring well construction should be researched and evaluated to the extent possible to identify and avoid potential PFAS interference. As discussed above, O-rings in valves, pipe thread sealant, gaskets and other materials can contain PFAS.

4.0 GROUNDWATER SAMPLING PROCEDURES

The following subsections present recommended sampling plan items and procedures to be used for sampling monitoring wells for PFAS. Additional background and procedural details are included in Appendix B, MDEQ Groundwater PFAS Sampling Guidance.

Groundwater sampling methods for PFAS must include purging at least three well volumes prior to sample collection. Methods for well purging may include bailing, peristaltic pumps, inertia/foot valve operated pumps, bladder pumps with polyethylene bladders, or submersible pumps as long as the equipment is tested, and PFAS-free discharge is attainable using laboratory-supplied blank water. Low-flow (minimal-drawdown) procedures can be used, as long as at least three well volumes are removed. A combined method like purging with a submersible pump and sample collection with a bailer may also be used.

4.1 Representative Sample Considerations

The site-specific sampling plan should evaluate the proposed sampling procedures and their likely effectiveness in producing samples that are representative of aquifer conditions or stated investigation objectives. The following situations should be considered:

- Monitoring wells screened deeper in the aquifer – Due to purge volumes, a submersible pump should be considered. The submersible pump intake should be placed within the screened interval when possible.
- When the monitoring well is bailed or pumped dry – Samples should be collected as soon as possible once a sufficient sample volume is available after the well was purged dry.
- Repeatability – Flow cell readings like those collected during Low-flow sampling, should be used after well purging to document groundwater parameters in addition to pumping rate.
- Over-pumping – Excessive pumping rates may result in a diluted sample.

4.2 Groundwater Sample Collection

A two-person sampling team is recommended during sample collection. Powder-free Nitrile gloves must always be worn and changed as often as necessary. MDEQ guidance suggests that sample containers can be labeled with ballpoint pens or fine or ultrafine point Sharpie® markers and not regular or thick-size while the lid is securely placed on the container. Containers for groundwater samples are not preserved. Samples are to be collected directly from the bailer or discharge tubing (not through flow-cell) gently into laboratory supplied-HDPE containers, with non-Teflon caps. Container caps are to be removed just prior to sample collection and replaced as soon as containers are filled. Container caps should be held by a sample team member during sampling. Filtration of groundwater samples for PFAS is not recommended. Following sample collection, the bottles are to be placed in a Ziploc® bag, the bag is to be sealed and placed in a laboratory-supplied cooler containing wet ice. “Blue Ice” is not recommended due to potential PFAS contamination. Detailed notes of the sampling process and field conditions at the time of each sample should be documented.

4.3 Quality Control Samples

The following types of blanks should be incorporated into the site-specific sampling plan based on the analysis of potential cross-contamination sources.

Field & Equipment Blanks

Equipment blanks consist of laboratory verified PFAS-free lab water poured over (static water level meters) or through (pumps and bailers) the sampling equipment, collected in laboratory-supplied sample containers.

- Field (atmospheric) blanks should be collected at least once per day if a nearby source of airborne PFAS is suspected. Field blanks consist of laboratory verified PFAS-free lab water in a laboratory supplied sample container. A field blank is opened at the sampling site and exposed to ambient conditions for approximately the same amount of time as an actual sampling container is open. PFAS-free lab water can be poured from one sample container into another to mimic sample collection activities. The field blank then travels with the field samples and is analyzed in the same batch.
- Equipment blanks should be collected prior to the first use of sampling equipment in the field and after each decontamination.
- Equipment blanks should be collected from representative samples of disposable sampling equipment to document that these items are not a potential contributing source for PFAS. This includes gloves, tubing, markers, or other items in close contact with the groundwater sample.

Duplicate Samples

Duplicate samples are collected by filling a second set of sample containers simultaneously from one sampling point. The second set of containers is labeled Duplicate-# so the lab is unaware of the origin. The location of each duplicate sample is documented in the field notes, not on the Chain of Custody. One duplicate sample per day or every ten samples is recommended.

Trip blanks

Trip blanks consist of laboratory-verified PFAS-free lab water in a laboratory-supplied sample container. Trip blanks travel with the field samples and are analyzed in the same batch.

5.0 DRINKING WATER SAMPLING PROCEDURES

The following subsections present recommended sampling plan items and procedures to be used for sampling residential wells for PFAS. Additional background and procedural details are included in Appendix C, EGLE For Technical Staff and Contractors – Residential Well PFAS Sampling Guidance.

Residential drinking water well sampling procedures begin with the same potential PFAS cross-contamination precautions for field equipment, sampler clothing/PPE/PCP, well/infrastructure construction, and representative sample collection as was described above. These precautions should include a preparation of a site-specific sampling plan and obtaining the water well record for the subject well from online sources such as Wellogic wells on the EGLE GeoWebFace, older scanned records through the EGLE website that are searchable by Section, Town and Range, or by contacting the local health department. It is assumed that the owner of the well has granted permission to sample the well and arrangements have been made to schedule the sampling. The following section presents procedures and considerations that are different for drinking water samples.

Drinking Water Sample Collection

The sampling team should visually assess the water system to identify a sample tap. Whenever possible, the sampling tap should not be treated by filtration, softening, inorganic removal, etc. The sampling tap can be located inside or outside of the building, but a hose should not be used to purge or collect a sample. Water purged from an outside tap can be diverted away from the structure using buckets to haul it away. To purge the system, the cold water tap should be opened and allowed to run for at least five minutes or until the water temperature stabilizes. Drinking water samples are to be gently collected into pre-preserved (Trizma®), laboratory supplied containers and handled as described above. The containers should be agitated softly to dissolve the preservative. QC samples should be collected according to the sampling plan, based on recommendations listed above. Detailed sampling notes should include typical date/time/sampler initials, as well as a water system construction description, treatment system details, sample tap location and construction, and purge times.

6.0 WASTEWATER SAMPLING PROCEDURES

The following subsections present recommended sampling plan items and procedures to be used for sampling wastewater for PFAS. Additional background and procedural details are included in Appendix D, MDEQ Wastewater PFAS Sampling Guidance.

Wastewater sampling procedures begin with the same potential PFAS cross-contamination precautions for field equipment, sampler clothing/PPE/PCP, well/infrastructure construction, and representative sample collection as was described above. These precautions should include a preparation of a site-specific sampling plan, including an evaluation of the methods and location for representative sample collection. The following section presents procedures and considerations that are different for wastewater samples.

Wastewater Sample Collection

The sampling team should visually assess the wastewater system to identify a safe, representative sampling location. Site-specific health and safety concerns, such as hydrogen sulfide and pathogen risks should be identified and evaluated as part of the sampling plan. Two methods are available for wastewater PFAS sampling, grab sampling and automatic sampling. Grab sampling is preferred, if it can result in a representative sample, due to the simplicity in the number of materials introduced to the sample. Generally, a scoop or bottle is lowered into the wastewater using a pole or extendable long handle, and then the sample material is transferred to unpreserved laboratory-supplied containers. However, automatic sampling may be required for representative samples in waste streams. Automatic samplers consist of an insulated container with a peristaltic type pump that is activated by a timer. The intake line is HDPE (non-Teflon) tubing with a weighted strainer and is replaced after each use. Detailed sampling notes should include specific sampling equipment identification and methods, as well as sample location and infrastructure details.

7.0 SOIL SAMPLING PROCEDURES

The following subsections present recommended sampling plan items and procedures to be used for sampling soil for PFAS. Additional background and procedural details are included in Appendix E, MDEQ Soil PFAS Sampling Guidance.

Soil sampling procedures begin with the same potential PFAS cross-contamination precautions for field equipment, sampler clothing/PPE/PCP, and representative sample collection as was described above. These precautions are even more complicated for soil investigations if equipment (direct push or auger rigs) is needed to obtain the samples. These precautions should include a preparation of a site-specific sampling plan, including a thorough evaluation of the methods and equipment to be used for sample collection. The following section presents procedures and considerations that are different for soil sampling.

Soil Sample Collection

Soil sampling for PFAS generally consists of obtaining a sample using documented (through equipment blanks), PFAS-free equipment such as a hand auger or HDPE lined split spoon or direct push samplers. Grab samples are transferred into unpreserved, laboratory-supplied polyethylene containers. Detailed sampling notes should include date, time, depth of sample, specific sampling equipment identification and methods as well as site and atmospheric conditions at the time of sample collection.

8.0 SURFACE WATER SAMPLING PROCEDURES

The following subsections present recommended sampling plan items and procedures to be used for sampling surface water for PFAS. Additional background and procedural details are included in Appendix F, MDEQ Surface Water PFAS Sampling Guidance.

Surface water sampling procedures begin with the same potential PFAS cross-contamination precautions for field equipment, sampler clothing/PPE/PCP, and representative sample collection as was described above. These precautions should include a preparation of a site-specific sampling plan, including an evaluation of the methods and location for representative sample collection. The following section presents procedures and considerations that are different for surface water samples.

Surface Water Sample Collection

The sampling team should visually assess the surface water body to identify a safe, representative sampling location. Site-specific health and safety concerns, such as potential rough water, current, depth and drowning risks should be identified and evaluated as part of the sampling plan. Surface water samples can be collected as a simple grab sample (directly into the sample bottle), a grab sample at a

select depth (with transfer to the sample bottle), or as a depth integrated sample (with collection at multiple depths into one container or collection at multiple depths with several containers, ultimately composited and transferred to the sample bottle). Two methods are utilized for surface water PFAS sampling and are depth dependent (0-5 feet and over 5 feet). Container immersion can be completed with extension rods or submersible devices, selection of the proper tool is based on sample depth. Direct sampling is completed by collecting the water sample directly into the sample container. All techniques should be completed upstream of the sampler. Sample bottles should be HDPE or polypropylene bottles with Teflon®-free caps, provided by the laboratory. Samples should be double bagged using Ziploc® disposable bags. Filtering of surface water samples should be avoided, and minimal disturbance of sediments will reduce the need. However, if samples must be filtered, discussions with the laboratory and Gosling Czubak project team are necessary to confirm procedures. Detailed sampling notes should include date, time, depth of sample, specific sampling equipment identification and methods as well as site and atmospheric conditions at the time of sample collection.

9.0 LABORATORY METHODS

Laboratory methods are continuing to evolve and should be reviewed regularly. The laboratory selected to be part of the project team should be asked to provide the method and analyte list to be compared to current EGLE guidance. For EGLE-regulated sites, the USEPA Method 537, Version 1.1. must be used for drinking water samples. Different laboratories have developed modified methods to analyze soil, wastewater, animal tissue and other media. It is important to work with laboratory representatives as part of the site-specific sampling plan. Analyte lists and reporting limits should be reviewed and compared to current EGLE guidance.

All samples collected for PFAS are to be handled using proper chain of custody procedures. Samples are to be cooled to 10°Celsius or less and shipped on wet ice. The laboratory is to be notified of samples that are suspected of containing high concentrations of PFAS that could “spike” their equipment calibration.

Appendix A: MDEQ PFAS Sampling Quick Reference Field Guidance



MDEQ PFAS SAMPLING QUICK REFERENCE FIELD GUIDE¹

All Items Used During Sampling Event

● Prohibited
<ul style="list-style-type: none"> • Items or materials that contain fluoropolymers such as <ul style="list-style-type: none"> ○ Polytetrafluoroethylene (PTFE), that includes the trademarks Teflon® and Hostaflon® ○ Polyvinylidene fluoride (PVDF), that includes the trademark Kynar® ○ Polychlorotrifluoroethylene (PCTFE), that includes the trademark Neoflon® ○ Ethylene-tetrafluoro-ethylene (ETFE), that includes the trademark Tefzel® ○ Fluorinated ethylene propylene (FEP), that includes the trademarks Teflon® FEP and Hostaflon® FEP • Items or materials that contain any other fluoropolymer

Pumps, Tubing, and Sampling Equipment

● Prohibited	■ Allowable	▲ Needs Screening ²
<ul style="list-style-type: none"> • Items or materials containing any fluoropolymer (potential items include tubing, valves, or pipe thread seal tape) 	<ul style="list-style-type: none"> • High-density polyethylene (HDPE) • Low-density polyethylene (LDPE) tubing • Polypropylene • Silicone • Stainless-steel • Any items used to secure sampling bottles made from: <ul style="list-style-type: none"> ○ Natural rubber ○ Nylon (cable ties) ○ Uncoated metal springs ○ Polyethylene 	<ul style="list-style-type: none"> • Any items or materials that will come into direct contact with the sample that have not been verified to be PFAS-free <ul style="list-style-type: none"> ○ Do not assume that any sampling items or materials are PFAS-free based on composition alone

Sample Storage and Preservation

● Prohibited	■ Allowable	▲ Needs Screening ²
<ul style="list-style-type: none"> • Polytetrafluoroethylene (PTFE): Teflon® lined bottles or caps 	<ul style="list-style-type: none"> • Glass jars⁴ • Laboratory-provided PFAS-Free bottles: <ul style="list-style-type: none"> ○ HDPE or polypropylene • Regular wet ice • Thin HDPE sheeting • LDPE resealable storage bags (i.e. Ziploc®) that will not contact the sample media⁶ 	<ul style="list-style-type: none"> • Aluminium foil⁴ • Chemical or blue ice⁵ • Plastic storage bags other than those listed as ■ Allowable • Low-density polyethylene (LDPE) bottles

Field Documentation

● Prohibited	■ Allowable	▲ Needs Screening ²
<ul style="list-style-type: none"> • Clipboards coated with PFAS • Notebooks made with PFAS treated paper • PFAS treated loose paper • PFAS treated adhesive paper products 	<ul style="list-style-type: none"> • Loose paper (non-waterproof, non-recycled) • Rite in the Rain® notebooks • Aluminium, polypropylene, or Masonite field clipboards • Ballpoint pens, pencils, and Fine or Ultra-Fine Point Sharpie® markers 	<ul style="list-style-type: none"> • Plastic clipboards, binders, or spiral hard cover notebooks • All markers not listed as ■ Allowable • Post-It® Notes or other adhesive paper products • Waterproof field books

Decontamination

● Prohibited	■ Allowable	▲ Needs Screening ²
<ul style="list-style-type: none"> • Decon 90® • PFAS treated paper towel 	<ul style="list-style-type: none"> • Alconox®, Liquinox®, or Citranox® • Triple rinse with PFAS-free deionized water • Cotton cloth or untreated paper towel 	<ul style="list-style-type: none"> • Municipal water • Recycled paper towels or chemically treated paper towels

Clothing, Boots, Rain Gear, and PPE

● Prohibited	■ Allowable	▲ Needs Screening ²
<ul style="list-style-type: none"> • New or unwashed clothing • Anything made of or with: <ul style="list-style-type: none"> ○ Gore-Tex™ or other water-resistant synthetics • Anything applied with or recently washed with: <ul style="list-style-type: none"> ○ Fabric softeners ○ Fabric protectors, including UV protection ○ Insect resistant chemicals ○ Water, dirt, and/or stain resistant chemicals 	<ul style="list-style-type: none"> • Powderless nitrile gloves • Well-laundered synthetic or 100% cotton clothing, with most recent launderings not using fabric softeners • Made of or with: <ul style="list-style-type: none"> ○ Polyurethane ○ Polyvinyl chloride (PVC) ○ Wax coated fabrics ○ Rubber / Neoprene ○ Uncoated Tyvek® 	<ul style="list-style-type: none"> • Latex gloves • Water and/or dirt resistant leather gloves • Any special gloves required by a HASP • Tyvek® suits, clothing that contains Tyvek®, or coated Tyvek®

Food and Beverages

● Prohibited	■ Allowable
<ul style="list-style-type: none"> • No food should be consumed in the staging or sampling areas, including pre-packaged food or snacks. <ul style="list-style-type: none"> ■ If consuming food on-site becomes necessary, move to the staging area and remove PPE. After eating, wash hands thoroughly and put on new PPE. 	<ul style="list-style-type: none"> • Brought and consumed only outside the vicinity of the sampling area: <ul style="list-style-type: none"> ○ Bottled water ○ Hydration drinks (i.e. Gatorade®, Powerade®)

Personal Care Products (PCPs) - for day of sample collection⁶

● Prohibited	■ Allowable	▲ Needs Screening ²
<ul style="list-style-type: none"> • Any PCPs⁶, sunscreen, and insect repellent applied in the sampling area. 	<p>PCPs⁶, sunscreens, and insect repellents applied in the staging area, away from sampling bottles and equipment followed by thoroughly washing hands:</p> <p>PCPs⁶:</p> <ul style="list-style-type: none"> • Cosmetics, deodorants/antiperspirants, moisturizers, hand creams, and other PCPs⁶ <p>Sunscreens:</p> <ul style="list-style-type: none"> • Banana Boat® for Men Triple Defense Continuous Spray Sunscreen SPF 30 • Banana Boat® Sport Performance Coolzone Broad Spectrum SPF 30 • Banana Boat® Sport Performance Sunscreen Lotion Broad Spectrum SPF 30 • Banana Boat® Sport Performance Sunscreen Stick SPF 50 • Coppertone® Sunscreen Lotion Ultra Guard Broad Spectrum SPF 50 • Coppertone® Sport High Performance AccuSpray Sunscreen SPF 30 • Coppertone® Sunscreen Stick Kids SPF 55 • L'Oréal® Silky Sheer Face Lotion 50 • Meijer® Clear Zinc Sunscreen Lotion Broad Spectrum SPF 50 • Meijer® Sunscreen Continuous Spray Broad Spectrum SPF 30 • Meijer® Clear Zinc Sunscreen Lotion Broad Spectrum SPF 15, 30 and 50 • Meijer® Wet Skin Kids Sunscreen Continuous Spray Broad Spectrum SPF 70 • Neutrogena® Beach Defense Water+Sun Barrier Lotion SPF 70 • Neutrogena® Beach Defense Water+Sun Barrier Spray Broad Spectrum SPF 30 • Neutrogena® Pure & Free Baby Sunscreen Broad Spectrum SPF 60+ • Neutrogena® UltraSheer Dry-Touch Sunscreen Broad Spectrum SPF 30 <p>Insect Repellents:</p> <ul style="list-style-type: none"> • OFF® Deep Woods • Sawyer® Permethrin 	<ul style="list-style-type: none"> • Products other than those listed as <ul style="list-style-type: none"> ■ Allowable

¹ This table is not considered to be a complete listing of prohibited or allowable materials. All materials should be evaluated prior to use during sampling. The manufacturers of various products should be contacted in order to determine if PFAS was used in the production of any particular product.

² Equipment blank samples should be taken to verify these products are PFAS-free prior to use during sampling.

³ **For surface water foam samples:** LDPE storage bags may be used in the sampling of foam on surface waters. In this instance, it is allowable for the LDPE bag to come into direct contact with the sample media.

⁴ **For fish and other wildlife samples:** Depending on the project objectives, glass jars and aluminum foil might be used for PFAS sampling. PFAS has been found to bind to glass and if the sample is stored in a glass jar, a rinse of the jar is required during the sample analysis. PFAS are sometimes used as a protective layer for some aluminum foils. An equipment blank sample should be collected prior to any aluminum foil use.

⁵ Regular ice is recommended as there are concerns that chemical and blue ice may not cool and maintain the sample at or below 42.8°F (6°C) (as determined by EPA 40 CFR 136 – NPDES) during collection and through transit to the laboratory.

⁶ Based on evidence, avoidance of PCPs is considered to be precautionary because none have been documented as having cross-contaminated samples due to their use. However, if used, application of PCPs must be done at the staging area and away from sampling bottles and equipment, and hands must be thoroughly washed after the use of any PCPs prior to sampling.

Appendix B: MDEQ Groundwater PFAS Sampling Guidance



GROUNDWATER PFAS SAMPLING

Guidance

Introduction

This sampling guidance discusses the processes and acceptable items and materials that should be used when sampling groundwater monitoring wells for per- and polyfluoroalkyl substances (PFAS). The guidance primarily addresses the collection of representative water samples from the subsurface saturated zone. In addition, this guidance will be used to support the sampling objectives and procedures based on the Quality Assurance Project Plan (QAPP) developed prior to sampling activities. This guidance assumes staff has basic familiarity with and/or understanding of basic groundwater sampling procedures.

NOTE: Review the **General PFAS Sampling Guidance** document prior to reviewing this guidance document.

This sampling guidance may be varied or changed as required, depending on site conditions, equipment limitations, or limitations imposed by the procedure. The ultimate procedures used should be documented in the final report.

The MDEQ intends to update the information contained within this Groundwater PFAS Sampling Guidance document as new information becomes available. The user of this Groundwater PFAS Sampling Guidance is encouraged to visit the Michigan PFAS Action Response Team (MPART) webpage (www.michigan.gov/PFASresponse) to access the most current version of this document.

PFAS has been detected in groundwater in Michigan at concentrations over 810,000 parts per trillion (ppt). Many commercial laboratories have extremely low PFAS detection limits of about 1 ppt. Therefore, there is a high potential of false positives if proper procedures are not followed during sample collection.

This Groundwater PFAS Sampling Guidance discusses the collection of groundwater samples and methods to prevent cross-contamination that can occur from:

- Field clothing and personal protective equipment (PPE)
- Personal care products (PCPs)
- Food Packaging
- Sampling equipment
- Equipment decontamination
- Filtering of surface water
- Sample collection and handling
- Sample shipment

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1. Potential Sources for PFAS Cross-Contamination

Potential sources for PFAS cross-contamination include items and materials used within the sampling environment, such as sampling equipment, field clothing, personal protective equipment (PPE), sun and biological protection products, personal hygiene, personal care products (PCPs), and food packaging. A detailed discussion about potential sources for PFAS cross-contamination is included in the **General PFAS Sampling Guidance**, which should be reviewed before reading this document. However, a high-level summary is presented in this guidance.

All of the items and materials discussed in each of the MDEQ's PFAS Sampling Guidance Documents are divided into three major groups:

- Prohibited (●) identifies items and materials that should not be used when sampling. It is well documented that they contain PFAS or that PFAS are used in their manufacture.
- Allowable (■) identifies items and materials that have been proven not to be sources of PFAS cross contamination and are considered acceptable for sampling.
- Needs Screening (▲) identifies items and materials that have the potential for PFAS cross-contamination due to a lack of scientific data or statements from manufacturers to prove otherwise. These items and materials are further sub-divided into two categories:
 - **Category 1:** Items and materials that will come in direct contact with the sample. These should not be used when sampling unless they are known to be PFAS-free, by collecting an equipment blank sample prior to use.
 - **Category 2:** Items and materials that will not come in direct contact with the sample. These should be avoided, if possible, unless they are known to be PFAS-free by collecting an equipment blank sample prior to use.

Please note that at this time no published research is available that documents the use of various materials and effect on sample results. Therefore, a conservative approach is recommended, and the guidance is based on the collection of multiple environmental samples at various PFAS sites. Sampling staff should take practical and appropriate precautions to avoid items that are likely to contain PFAS at the sampling site as well as avoid specific items during the sampling event.

A general overview of PFAS contamination sources during sampling can be found in **Section 4.2** of the **General PFAS Sampling Guidance**. Any items or materials utilized that are not identified in this guidance or not discussed in **Section 4.2** should be evaluated as described in **Section 4.2.1 of the General PFAS Sampling Guidance**.

Sampling staff should take practical and appropriate precautions to avoid items that are likely to contain PFAS at the sampling site as well as avoid specific items during the sampling event (see below).

1.1 Field Clothing and PPE

Materials, field clothing, and equipment screening should be performed during the QAPP development or the planning phase of sampling programs. The screening should be performed on all items and materials that are expected to come into contact with the samples and are defined as **Category 1**. Due to the extensive use of PFAS in many industries and

products, PPE may contain PFAS. During a PFAS investigation, PPE containing PFAS should be avoided to prevent cross-contamination.

As with any field mobilization, it is the responsibility of all personnel to be aware of the physical, chemical, and biological hazards associated with a particular site. Personal safety is paramount. The safety of staff should not be compromised by fear of PFAS-containing items or materials without any scientific basis. Any deviation from this guidance, including those necessary to ensure the health and safety of sampling personnel, should be recorded in field notes and discussed in the final report.

Any additional field clothing and/or PPE items that might be required for groundwater sampling and not discussed in this sampling guidance should be evaluated as described in **Sections 4.2.1** and **4.2.2** of the **General PFAS Sampling Guidance**.

NOTE: Special attention should be given to clothing that has been advertised as having waterproof, water-repellant, or dirt and/or stain characteristics. They are likely to have PFAS in their manufacturing.

Field sampling during wet weather (e.g., rainfall and snow) should be conducted while wearing the proper field clothing.

- Dust and fibers must not be allowed to collect on field clothing or PPE.
- Do not use clothing that has been advertised as waterproof, dirt and/or stain repellent that has not been verified to be made of PFAS-free materials.
- Use powderless nitrile gloves
- Only use clothing/PPE that has been verified to be made of PFAS-free materials.
- ▲ Latex gloves should be screened before use.

Powderless nitrile gloves should be changed frequently any time there is an opportunity for cross-contamination. See **Section 5** of this guidance for additional glove instructions.

1.2 Personal Care Products (PCPs)

A number of sampling guidance documents recommend that personal hygiene and PCPs (e.g., cosmetics, shampoo, sunscreens, dental floss, etc.) not be used prior to and on the day(s) of sampling because the presence of PFAS in these products has been documented (OECD, 2002, Fujii, 2013, Borg and Ivarsson, 2017). However, if the MDEQ's sampling SOPs are followed, these items should not come into contact with the sampling equipment or the sample being collected. As of the date of this sampling guidance, cross-contamination of samples due to the use of PCPs has not been documented during the collection of thousands of samples. However, field personnel should be aware of the potential of cross-contamination of the sampling equipment or actual samples would come into contact with these products. The following precautions should be taken when dealing with personal hygiene or PCPs before sampling:

- Do not handle or apply PCPs in the sampling area.
- Do not handle or apply PCPs while wearing PPE that will be present during sampling.
- Move to the staging area and remove PPE if applying personal care products becomes necessary.
- Wash hands thoroughly after the handling or application of PCPs and, when finished, put on a fresh pair of powderless nitrile gloves.

1.3 Food Packaging

PFAS has been used by the paper industry as a special protective coating against grease, oil, and water for paper and paperboards, including food packaging since the late 1950s (Trier et al., 2018). PFAS application for food packaging includes paper products that come into contact with food such as paper plates, food containers, bags, and wraps (OECD, 2002). Pre-wrapped food or snacks (such as candy bars, microwave popcorn, etc.) must not be in the sampling and staging areas during sampling due to PFAS contamination of the packaging. When staff requires a break to eat or drink, they should remove their gloves, coveralls, and any other PPE, if worn, in the staging area and move to the designated area for food and beverage consumption. When finished, staff should wash their hands and put on a fresh pair of powderless nitrile gloves at the staging area, before returning to the sampling area.

- Do not handle, consume, or otherwise interact with pre-wrapped food or snacks, carry-out food, fast food, or other food items while on-site during sampling.
- Move to the staging area and remove PPE prior to leaving the sampling and staging areas if consuming food on site becomes necessary.

2. Groundwater Sampling Equipment

Do not use any equipment that contains any known fluoropolymers including, but not limited to:

- Do not use polytetrafluoroethylene (PTFE), that includes the trademark Teflon® and Hostaflon®, which can be found in many items, including but not limited to ball check-valves on certain bailers, the lining of some hoses and tubing, some wiring, certain kinds of gears, lubricant, and some objects that require the sliding action of parts.
- Do not use Polyvinylidene fluoride (PVDF), that includes the trademark Kynar®, which can be found in many items, including but not limited to tubing, films/coatings on aluminum, galvanized or aluminized steel, wire insulators, and lithium-ion batteries.
- Do not use Polychlorotrifluoroethylene (PCTFE), that includes the trademark Neoflon®, which can be found in many items, including but not limited to valves, seals, gaskets, and food packaging.
- Do not use Ethylene-tetrafluoro-ethylene (ETFE), that includes the trademark Tefzel®, which can be found in many items, including but not limited to wire and cable insulation and covers, films for roofing and siding, liners in pipes, and some cable tie wraps.
- Do not use Fluorinated ethylene propylene (FEP), that includes the trademarks Teflon® FEP and Hostaflon® FEP, and may also include Neoflon®, which can be found in many items, including but not limited to wire and cable insulation and covers, pipe linings, and some labware.
- Do not use low density polyethylene (LDPE) for any items that will come into **direct contact** with the sample media. LDPE can be found in many items, including but not limited to containers and bottles, plastic bags, and tubing.
 - ▲ **However**, LDPE may be used if an equipment blank has confirmed it to be PFAS-free. LDPE does not contain PFAS in the raw material but may contain PFAS cross-contamination from the manufacturing process.
- LDPE bags (e.g., Ziploc®) that **do not** come into direct contact with the sample media and do not introduce cross-contamination with samples may be used.

NOTE: Manufacturers can change the chemical composition of any product. As a result, all materials that will come into direct contact with the sample media (defined as Category 1) should be tested to confirm they are “PFAS-free,” i.e. will not contaminate samples at detectable levels. **There is no guarantee that materials in the “Allowable” category will always be PFAS-free.**

- Use items and materials that are either made of high-density polyethylene (HDPE), polypropylene, silicone, polyvinyl chloride(PVC), or acetate.
- Keep tubing in the original cardboard or bag in which it was shipped.
- Store tubing in a clean location free of dust and fibers.
- Use nylon line, cotton string, or other PFAS-free material when raising and lowering bailers.
- When using bladder pumps, use pumps made of stainless steel with polyethylene bladders.
- Glass bottles or containers may be used if they are known to be PFAS-free, however, PFAS have been found to adsorb to glass, especially when the sample is in contact with the glass for a long period of time (e.g. being stored in a glass container). If the sample comes into direct contact with the glass for a short period of time (e.g. using a glass container to collect the sample, then transferring the sample to a non-glass sample bottle), the adsorption is minimal.
- ▲ In many submersible pumps, the O-Rings do not come into contact with the groundwater sample, and in this case, the O-Rings should be treated as internal pump components. The O-Rings present a low possibility of cross-contamination. Equipment blanks should be collected simulating actual field sampling procedures and not for individual pump components.

Field rental equipment companies offer “PFAS-free” bladder pumps; however, caution is advised, and an equipment rinsate blank is required. Rental equipment should be treated as being contaminated and only used after proper decontamination has been done.

Staff should follow the **MDEQ PFAS Sampling Quick Reference Field Guide** at the end of this document for approved and prohibited items for documenting and sampling groundwater for PFAS.

3. Equipment Decontamination

It is customary with groundwater sampling that the equipment is decontaminated before the sampling event. If the previous user of the equipment is not known, and it is unclear how the equipment was handled—especially rental equipment—decontaminate the equipment before sampling. Any **Category 1** non-dedicated sampling equipment (equipment used for more than one location) must be verified as PFAS free before use.

For non-dedicated **Category 1** sampling equipment, the following materials and procedures must be used for decontamination:

- Do not use Decon 90®.
- Laboratory supplied PFAS-free deionized water is preferred for decontamination.
- Alconox®, Liquinox®, and Citranox® can be used for equipment decontamination.
- Sampling equipment can be scrubbed using a polyethylene or Polyvinyl chloride (PVC) brush to remove particulates.
- Decontamination procedures should include triple rinsing with PFAS-free water.
- Commercially available deionized water in an HDPE container may be used for decontamination if the water is verified to be PFAS-free.
- ▲ Municipal drinking water may be used for decontamination purposes if it is known to be PFAS-free.

NOTE: All samples must be collected using PFAS-free High-Density Polyethylene (HDPE), glass, or polypropylene bottles provided by the laboratory, with Teflon®-free caps.

4. Groundwater Sample Collection Methods

4.1 Method summary

Before a well is sampled, stagnant water in the well casing must be removed or purged in order to obtain a representative groundwater sample. The instruments most commonly used for purging by the MDEQ are bailers, submersible pumps, and inertia pumps. MDEQ staff may oversee purging and sampling conducted by noncontact gas bladder pumps, suction-lift pumps, and other pumps, but the MDEQ does not typically use these pumps. The MDEQ typically samples groundwater using bailers, or by low-flow methods utilizing a peristaltic pump.

Prior to purging, the water level in the well and the total depth of the well should be measured, using the procedures described in the QAPP to determine the volume of water in the well. When using a bailer, a minimum of three well volumes should be purged, unless the well runs dry. When using low-flow methods, purging should continue until the selected indicator parameters have stabilized (see **Section 4.7 Low-Flow Methods**).

Once purging is completed or the groundwater in the well recovers, the groundwater pH, temperature, specific conductance, and turbidity should be measured using the procedures described in the QAPP. After the correct sample containers have been prepared, sampling may proceed. Care should be taken when choosing the sampling device, since some devices may affect the integrity of the sample.

NOTE: Purging is mandatory in all cases where there is the potential for the data to be used for enforcement purposes.

Purging and sampling should occur in a progression from the least contaminated well to the most contaminated well, if this information is known; disposable equipment should be used for each well or equipment must be decontaminated prior to use and between each well.

4.2 Calculations

If it is necessary to calculate the volume of water in the well, use the following equation:

$$\text{Well volume (gallons)} = \pi r^2 h (\text{cf})$$

where:

r = radius of monitoring well (feet)

h = height of the water column (feet) (This may be determined by subtracting the depth to the water from the total depth of the well as measured from the same reference point.)

cf = conversion factor (gallons/linear foot) = 7.48 gal/ft³

If the diameter of the monitoring well is known, standard conversion factors can be applied to simplify the equation above. Monitoring well diameters are typically two, three, four, or six inches.

Well volumes, in gallons per linear foot, for these common monitoring well diameters are as follows:

Well diameter	2-inches	3-inches	4-inches	6-inches
Volume (gal/ft.)	0.1632	0.3672	0.6528	1.4688

The volume of water in the well can then be calculated by multiplying the appropriate value of gallons per linear foot by the height of the water column in feet (h).

This well volume is typically tripled to determine the volume to be purged.

4.3 Preparation Procedures

The success of any sampling effort depends on thorough preparation. The following steps should be followed in preparing for groundwater well sampling:

1. Determine the extent of the sampling effort, the sampling methods to be used, and the types and quantities of equipment and supplies needed.
2. Develop and implement a site-specific sampling plan.
3. Prepare the schedule and coordinate with the laboratory, staff, contractors, and the regulated facility, as appropriate.
4. Obtain necessary sampling and monitoring equipment and supplies.
5. Decontaminate or preclean equipment, and ensure that it is in working order.
6. Perform a general site survey prior to site entry in accordance with the site-specific Health and Safety Plan (HASP), if appropriate.
7. Identify all monitoring wells to be sampled.
8. Start at the least contaminated well, if known.
9. Powderless nitrile gloves should be changed between each discrete task in the well purging and sampling process.
10. Remove the locking well cap; note the location, time of day, date and general weather conditions in the field logbook or Monitor Well and Groundwater Data Sheets.
11. Remove the well casing cap.
12. Lower the water level measuring device into the well until the water surface is encountered. Refer to the QAPP for specific water level measurement procedures.
13. Measure the distance from the water surface to a known reference measuring point on the well casing or protective barrier post and record the distance in the field logbook or Monitor Well and Groundwater Data Sheets. Alternatively, if no known reference point is available, note that the water level measurement is from the top of the steel casing, top of the riser pipe from ground surface, or some specific position on the well head.
14. Measure total depth of the well and record the depth in the field logbook or Monitor Well and Groundwater Data Sheets.
15. Calculate the volume of water in the well and the volume to be purged using the equations in **Section 4.2 Calculations**.

4.4 Purging Procedures

Wells should be purged to ensure that a representative sample is obtained. Generally, at a minimum, purging of three well volumes is effective. Bailers, submersible pumps, and inertia pumps are the purging devices most commonly used.

NOTE: Reference and utilize the *MDEQ Purge Water Disposal Policy* for detailed purge water disposal procedures.

- Purge water should be containerized, characterized, and properly disposed of. Sample results for the well can be used to assist in waste characterization.

If no other option is available and only a small volume of purge water has been generated, purge water may be disposed of on the ground near the well.

- Do not dispose of purge water in a way that the disposal will exacerbate existing contamination.

4.4.1 Bailers

Bailers are the simplest purging device used and have many advantages. They generally consist of a rigid length of tube, with a ball check-valve at the bottom. A line is used to lower the bailer into the well and retrieve a volume of water.

Manual purging with bailers is best suited to shallow and/or narrow-diameter wells. For deep, larger-diameter wells that require purging large volumes of water, other devices may be more appropriate.

Procedures for purging with a bailer are as follows:

1. Determine the volume of water to be purged as described in **Section 4.2 Calculations**.
2. Attach the line to the bailer and slowly lower the bailer until it is completely submerged. Be careful not to drop the bailer to the water, as it causes turbulence and the possible loss of volatile organic contaminants. On the bailer's first trip down the well, it is good sampling practice to gently lower it to the bottom of the well casing so that the sampler has an adequate length of line in hand to bail the well dry, should it be needed.
3. Pull the bailer out in a manner that the line never touches the ground.
4. Empty the bailer into a graduated pail.
5. Collect and dispose of purge water in accordance with the *MDEQ Purge Water Disposal Policy* and any additional requirements in the site-specific sampling plan. If purge water is disposed of on the ground, this should be done away from the base of the well.

4.4.2 Submersible Pumps

The use of submersible pumps for purging is permissible, provided they are constructed of suitably noncontaminating materials. The chief drawback, however, is possible cross-contamination between wells. Although some units can be disassembled easily to allow surfaces contacted by contaminants to be cleaned, field decontamination may be difficult and require solvents that can affect sample analysis.

NOTE: Submersible pumps may be the only practical sampling device for extremely deep wells (greater than 300 feet of water). Under those conditions, it is recommended that dedicated pump systems be installed to eliminate the potential for cross-contamination of well samples.

The use of submersible pumps in multiple well-sampling programs should be carefully compared to other sampling mechanisms (e.g., bailers, peristaltic pumps). In many cases, a sample can be collected by a bailer after purging with a submersible pump.

Submersible pumps generally use one of two types of power supplies: electric or compressed gas. Electrically powered pumps can run off a 12-volt DC rechargeable

● - Prohibited ■ - Allowable ▲ - Needs Screening

battery, or a 110 or 220-volt AC power supply. Pumps powered by compressed air normally use a small electric or gas-powered air compressor. They may also utilize compressed gas (i.e., nitrogen) from bottles. Differently sized pumps are available for different depth or diameter monitoring wells.

Procedures for purging with a submersible pump are as follows:

1. Determine the volume of water to be purged as described in **Section 4.2 Calculations**.
2. Assemble the pump, hoses, and safety cable, then lower the pump into the well. Make sure the pump is deep enough so that all the water is not evacuated (running the pump dry may cause damage).
3. Determine the volume of water purged by discharging purged water into a graduated pail or by attaching a flow meter to the outlet hose.
4. Use a ground fault circuit interrupter or ground the generator to avoid possible electric shock.
5. Connect the power supply and purge the well until the specified volume of water has been evacuated. If the pumping rate exceeds the well recharge rate, lower the pumping rate, lower the pump further into the well, and continue pumping.
6. Collect and dispose purge waters in accordance with the *MDEQ Purge Water Disposal Policy* and any additional requirements in the site-specific sampling plan. If purge water is disposed on the ground, this should be done away from the base of the well.

4.4.3 Inertia Pumps

Inertia pumps, such as the WaTerra® pump and piston pump, are manually operated. They are the most appropriate to use when wells are too deep to bail by hand, or too shallow, narrow, or inaccessible for a submersible pump. Inertia pumps are made of plastic or stainless steel and may be either decontaminated or discarded.

Procedures for purging with an inertia pump are as follows:

1. Determine the volume of water to be purged as described in **Section 4.2 Calculations**.
2. Assemble the pump and lower it to the appropriate depth in the well.
3. Begin pumping manually, discharging the water into a graduated pail. Purge until the specified volume of water has been evacuated.
4. Collect and dispose purge waters in accordance with the *MDEQ Purge Water Disposal Policy* and any additional requirements in the site-specific sampling plan. If purge water is disposed on the ground, this should be done away from the base of the well.

4.5 Representative Sample Collection

The primary goal in performing groundwater sampling is to obtain a representative sample of the aquifer or water-bearing zone. Groundwater sampling results can be compromised in two primary ways: collecting a non-representative sample or handling the sample incorrectly.

A monitoring well will have little or no vertical mixing of the water, and stratification will occur. The well water in the screened section will mix with the groundwater due to normal flow patterns, but the well water above the screened section will remain isolated, become stagnant, and may no longer be representative of the groundwater quality. Also, stagnant water may contain foreign material inadvertently or deliberately introduced from the surface, resulting in a non-representative sample. To safeguard against collecting non-representative stagnant water, the following guidelines and techniques should be adhered to during sampling:

1. As a general rule, all monitoring wells should be purged prior to sampling; see **Section 4.3 Purging Procedures**. To obtain a representative sample, a minimum of three volumes of water in the well casing should be purged. When using low-flow methods, purging should continue until the selected indicator parameters have stabilized. Indicator parameters typically used in low-flow purging include groundwater pH, specific conductivity, turbidity, temperature, dissolved oxygen and oxidation-reduction potential. The appropriate set of indicator parameters for the specific sampling event should be chosen by the project manager in advance of the sampling event. Alternatively, for low-yielding groundwater formations, the well can be pumped dry. For deeper wells, packers can be used to isolate a portion of the screened interval, minimizing the volume of groundwater that must be purged. In a high-yielding groundwater formation and where there is no stagnant water in the well above the screened section, purging is not as critical.
2. When purging with a pump, the pump should be set within the screened interval. When sampling a screened well, the sample should also be collected from the same depth within the screened interval at which the pump was set.
3. The well should be sampled as soon as possible after purging.
4. For wells that are pumped or bailed to dryness prior to the purging procedure being completed, the well should be allowed to recover (for up to, but no longer than, 24 hours) prior to collecting a sample.
5. A non-representative sample can also result from excessive pre-pumping of the monitoring well. Stratification of the constituent concentration in the groundwater formation may occur, or heavier-than-water compounds may sink to the lower portions of the aquifer. Excessive pumping can dilute or increase the constituent concentrations relative to those at the sampling point of interest.
6. A sampling methodology must be used that accounts for the effects of aquifer heterogeneities, while minimizing alterations in water chemistry that could result from sampling disturbances. The MDEQ will accept properly conducted purging methods designed to minimize drawdown, by controlling the flow from the well while monitoring stabilization indicator parameters, commonly referred to as low-flow methods. Available low-flow procedures include:
 - United States Environmental Protection Agency (USEPA), Office of Research and Development, Office of Solid Waste and Emergency Responses, EPA/540/S-95/504, April 1996, USEPA Ground Water Issue, [Low-Flow \(Minimal Drawdown\) Ground-Water Sampling Procedures](#), Robert Puls and Michael Barcelona
 - USEPA, Region 1, July 30, 1996, Revision 3, [Low Stress \(Low-Flow\) Purging and Sampling Procedure for the Collection of Ground Water Samples from Monitoring Wells](#)

4.6 Low-Flow Methods

Low-flow sampling involves the slow removal of a minimal amount of water from a well to ensure that stagnant water is removed and that water in the well is representative of water in the formation. The advantage of low-flow sampling is that, when conducted properly, it avoids

● - Prohibited ■ - Allowable ▲ - Needs Screening

disrupting the formation and minimizes turbidity that can be introduced by other purging and sampling devices, such as bailers. Instead of removing a set volume of water from the well, low-flow sampling uses a pump (typically a peristaltic pump), set at a low rate of flow, to continuously remove water until a set of indicator parameters are stabilized.

Flow rates are typically on the order of 100 to 200 milliliters per minute (ml/min) and should never exceed 500 ml/min. Indicator parameters are measured using probes inside a flow through cell and may include pH, specific conductance, dissolved oxygen, oxidation-reduction (redox) potential, temperature, and turbidity. Not all indicators may be used for a specific sampling; staff is most likely to use pH, specific conductivity, temperature, and turbidity.

NOTE: For a detailed discussion of low-flow methods, see USEPA, Office of Research and Development, Office of Solid Waste and Emergency Responses, EPA/540/S-95/504, April 1996, USEPA Ground Water Issue, *Low-Flow (Minimal Drawdown) Ground-Water Sampling Procedures*, Robert Puls and Michael Barcelona

5. Groundwater Sample Collection Procedures

Groundwater samples can be collected using bailers, submersible pumps, inertia pumps, and peristaltic pumps used for purging. Several factors must be considered when choosing a sampling device, and care should be taken when reviewing the advantages or disadvantages of any one device (see **Section 2 Groundwater Sampling Equipment**). It may be appropriate to use a sampling device different than that used to purge. The most common example of this is the use of a submersible pump to purge and a bailer to sample.

The following considerations should be taken during sample collection to prevent contamination:

- Dust and fibers must be kept out of sample bottles.
- The sample cap should never be placed directly on the ground during sampling.
 - ▲ If sampling staff must set the sample bottle cap down during sample collection and a second member of the sampling crew (wearing a fresh pair of powderless nitrile gloves) is not available, set the cap on a clean surface (cotton sheeting, HDPE sheeting, triple rinsed cooler lid, etc.).
- Do not sample without powderless nitrile gloves.
- Regular/thick size markers (Sharpie® or otherwise) are to be avoided; as they may contain PFAS.
- Fine and Ultra-Fine point Sharpie® markers are acceptable to label the empty sample bottle while in the staging area provided the lid is on the sample bottle and gloves are changed following sample bottle labeling.
- Ballpoint pens may be used when labeling sample containers. If ballpoint pens do not write on the sample container labels, preprinted labels from the laboratory may be used.
- Hands should be well washed and gloved.
- Use HDPE or polypropylene sample bottles with Teflon®-free caps, provided by the laboratory.
- Commercially bought sample bottles used with automatic sampling equipment should be decontaminated prior to sampling and equipment blank samples should be collected using laboratory supplied PFAS-free water.
- Glass bottles or containers may be used if they are known to be PFAS-free, however, PFAS have been found to adsorb to glass, especially when the sample is in contact with the glass for a long period of time (e.g. being stored in a glass container). If the sample comes into direct contact with the glass for a short period of time (e.g. using a glass container to collect

the sample, then transferring the sample to a non-glass sample bottle), the adsorption is minimal.

- Bottles should only be opened immediately prior to sampling.
- Bottles should be capped immediately after collecting the sample.
- Samples should be double bagged using resealable low density polyethelene (LDPE) bags (e.g., Ziploc®).
- Follow any guidance or requirements in the PFAS analytical reference method that will be used for testing samples, for sample collection, storage, preservation, and holding times.
- In the absence of formal USEPA guidance for PFAS groundwater sample storage, the documentation in USEPA Method 537 Rev. 1.1 should be used as a guide for thermal preservation (holding temperature) and holding times for groundwater or other samples. Samples must be chilled during storage and shipment and must not exceed 50°F (10° C) during the first 48 hours after collection. Samples stored in the laboratory must be held at or below 50°F (10°C) until extraction but should not be frozen.
- Groundwater samples should be extracted as soon as possible but must be extracted within 14 days. Extracts must be stored at room temperature and analyzed within 28 days after extraction.
- ▲ Off-brand markers should be known to be PFAS free prior to use.
- ▲ Latex gloves should be screened before use.

NOTE: USEPA Method 537 Rev. 1.1 was developed for the analysis of finished drinking water samples **only**.

5.1 Bailers

1. Complete purging. Measure the groundwater pH, temperature, and specific conductance using the procedures described in the QAPP.
2. Assemble the appropriate sample containers, and label with appropriate sample labels.
3. Attach a nylon or cotton line to the bailer.
4. Lower the bailer slowly and gently into the well, attempt to minimize contact with the casing, and avoid splashing the bailer into the water. Stop lowering at a point adjacent to the screen.
5. Allow the bailer to fill and then slowly and gently retrieve the bailer from the well. Attempt to minimize contact with the casing, to ensure that flakes of rust or other foreign materials are not knocked into the bailer.
6. Remove the cap from the sample container and keep it in a gloved hand (two sample collection personnel may be needed).
7. Begin slowly pouring groundwater from the bailer into the sample container.
8. Replace the well cap once all sample containers are filled.
9. Cap the sample container tightly, label the container, and place the container in a temperature-controlled carrier.
10. Log all samples in the field logbook and on Monitor Well and Groundwater Data Sheets.
11. Package the samples for transport to the analytical laboratory. Complete chain-of-custody records.
12. Properly dispose of the bailer and line.

NOTE: For bailers especially, two sample collection personnel may be needed.

5.2 Submersible Pumps (Low-Flow Sampling)

1. Complete purging, keeping the pump approximately in the middle of the screened interval. Measure the groundwater pH, temperature, and specific conductance using the procedures described in the QAPP.
2. Assemble the appropriate sample containers, and label with the appropriate sample labels.
3. Reduce the purge water flow rate to a manageable sampling rate by adjusting the control box or by attaching a gate valve to the tubing (if not already fitted).
4. If the flow rate cannot be adjusted, run the water down the side of a clean jar and fill the sample containers from the jar.
5. Remove the pump and assembly. Dedicate the tubing to the monitoring well.
6. Replace the well cap once all sample containers are filled.
7. Cap the sample container tightly, label the container, and place it in a temperature-controlled carrier.
8. Log all of the samples in the field logbook and/or the Monitor Well and Groundwater Data Sheets.
9. Package the samples for transport to the analytical laboratory. Complete chain-of-custody records.
10. Decontaminate equipment in accordance with **Section 3 Equipment Decontamination**.

5.3 Inertia Pumps

1. Complete purging, keeping the pump approximately in the middle of the screened interval. Measure the groundwater pH, temperature, and specific conductance using the procedures described in the QAPP.
2. Assemble the appropriate sample containers, and label with appropriate sample labels.
3. Manually regulate the flow rate and discharge the sample from the pump outlet directly into the appropriate sample container.
4. Remove the pump from the well.
5. Replace the well cap once all sample containers are filled.
6. Cap the sample container tightly, label the container, and place it in a temperature-controlled carrier.
7. Log all samples in the field logbook and/or the Monitor Well and Groundwater Data Sheets.
8. Transport the samples to the decontamination zone, and package them for transport to the analytical laboratory. Complete chain-of-custody records.
9. Decontaminate equipment in accordance with **Section 3 Equipment Decontamination**.

5.4 Peristaltic Pumps (Low-Flow Sampling)

1. Determine that the indicator parameters (see **Section 4.4**) have stabilized. Complete purging, keeping the pump approximately in the middle of the screened interval. Record indicator parameters at 3-minute intervals.
2. Assemble the appropriate sample containers, and label with appropriate sample labels.
3. Collect samples.
4. Remove the pump and assembly. Dedicate the tubing to the monitoring well or properly dispose.
5. Replace the well cap once all sample containers are filled.
6. Cap the sample container tightly, label the container, and place it in a temperature-controlled carrier.
7. Log all samples in the field logbook and/or the Monitor Well and Groundwater Data Sheets.
8. Package the samples for transport to the analytical laboratory. Complete chain-of-custody records.
9. Decontaminate equipment in accordance with **Section 3 Equipment Decontamination**.

● - Prohibited ■ - Allowable ▲ - Needs Screening

When the depth to the water table exceeds 25 feet below grade, suction-lift mechanisms, such as peristaltic pumps, cannot be used to sample groundwater. A bladder or submersible pump can be used in the case when groundwater is located deeper than 25 feet below grade. Both of these pumps are submerged beneath the water table and will come into contact with the groundwater being sampled.

6. Field Quality Assurance/Quality Control

Sample blanks and duplicates are the primary means of assuring and assessing quality control during sample collection or transport.

Field blanks consist of:

- **Equipment blanks**

- Equipment blanks consist of laboratory verified PFAS-free water poured over (for equipment such as static water level indicators) or through (for equipment such as pumps, bailers and flow through cells) the sampling equipment, collected in laboratory-supplied sample containers, and analyzed.
- Equipment blanks should be collected prior to the first use of sampling equipment in the field (particularly if there is any uncertainty as to whether the equipment is constructed from PFAS containing materials) and occasionally after decontamination.
- Equipment blanks should be collected from a representative sample of disposable sampling equipment (one bailer from a box, a length of tubing from a roll) to document that these items are not contributing PFAS to groundwater samples.
- In the field, equipment blanks should be collected at a minimum frequency of one per day (or at a different frequency as specified in the sampling plan).

NOTE: Refer to the specific sampling plan to determine the appropriate number and frequency regarding field quality assurance and quality control.

- **Trip blanks**

- Trip blanks consist of laboratory-verified PFAS-free water in a laboratory-supplied sample container. Trip blanks travel with the field samples and are analyzed in the same batch.
- Typically trip blanks are collected to assess the potential cross contamination from VOCs. The current MDEQ minimum analyte PFAS list does not contain PFAS that are volatile.
- Trip blanks could be used to evaluate the potential cross-contamination present the lab in the containers or deionized water provided from the lab.

- **Field blanks**
 - Field blanks consist of laboratory verified PFAS-free water in a laboratory supplied sample container.
 - A field blank is opened at the sampling site and exposed to ambient conditions for approximately the same amount of time as an actual sampling container (generally 1 to 3 minutes). Alternately, the PFAS—free water can be poured from one sample container into another to mimic sample collection activities. The field blank then travels with the field samples and is analyzed in the same batch.
 - A field blank must be collected once every twenty samples (or at a different frequency as specified in sampling plan) or once during any sampling event, when an ambient source of PFAS (particularly atmospheric) is suspected.
 - If an atmospheric source of PFAS is suspected, collect the equipment blank downwind of the suspected source

- **Field duplicates**
 - Groundwater sample duplicates are two samples collected immediately sequentially from the same well. Duplicate samples should be labeled to prevent anyone, other than the sample collector, from knowing which specific well(s) are being duplicated.
 - Duplicates are analyzed in the same batch and serve as a quality check on the accuracy and precision of sampling procedures.
 - Duplicates are recommended once every ten samples or once per day (whichever is less; or at a different frequency as specified in the sampling plan.

7. Filtration

Filtering of the groundwater samples is sometimes necessary. PFAS can adsorb to particulate matter, and unfiltered samples may result in high biased results. However, the filter material should be carefully evaluated. A study between four different filter materials (PTFE, glass, polyethersulfone [PES], and nylon) found that glass filters adsorbed the least amount of PFAS and nylon adsorbed the most and is therefore not recommended for PFAS sampling.

NOTE: It is recommended that filtering of the samples should **only be performed in the laboratory** in order to reduce the possibility of cross contamination.

The following recommendations should be used when considering filtering of the samples:

- **Field filtration of the sample is generally not advised.**
 - ▲ If filtering is absolutely necessary, if specifically requested by a client or for other reasons:
 - Do not use any filters that contain any PFAS, such as PTFE filters
 - Do not use nylon filters.
 - Glass filters are recommended to be used.
 - Consider use of a centrifuge in the laboratory to reduce the need for sample filtering.

8. Sample Shipment

Once the sample is collected in laboratory-supplied containers, the following recommendations should be used for sample shipment:

- Check the cooler periodically to ensure samples are well iced and at the proper temperature.

- Refresh with regular ice, if needed, double bagged in LDPE resealable storage bags if needed.
- Regular ice should be used to cool and maintain the sample at or below the proper temperature.
 - ▲ Chemical or blue ice may be used if it is known to be PFAS-free and it is absolutely certain that the sample is cooled and maintained at or below the proper temperature during collection and through transit to the laboratory.
- Complete the appropriate Monitor Well and Groundwater Data Sheets.
- Shipping containers should be packed with enough PFAS-free noncombustible, absorbent, cushioning material, such as bubble wrap, to minimize the possibility of breakage.
- Complete a Chain of Custody (COC) form for each separate shipping container. The forms should be hand-carried to the laboratory by the sampler.
- If unable to hand-carry the COC and other forms to the laboratory, forms should be single bagged in LDPE (e.g. Ziploc®) storage bags and taped to the inside of the cooler lid.
- The cooler should be taped closed with a custody seal and, if shipping, shipped by overnight courier.
- Samples should be shipped as soon as possible (e.g. overnight) to ensure the samples arrive within the analytical holding time specified by the lab.

NOTE: Chain-of-custody procedures must be followed and documented.

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Appendix C: EGLE For Technical Staff and Contractors – Residential Well
PFAS Sampling Guidance

FOR TECHNICAL STAFF AND CONTRACTORS - RESIDENTIAL WELL PFAS SAMPLING

Introduction

This sampling guidance discusses the processes and acceptable items and materials that should be used by Michigan Department of Environment, Great Lakes, and Energy (EGLE) and local health department staff conducting residential well sampling for per- and polyfluoroalkyl substances (PFAS). This guidance will be used to support the sampling objectives and procedures based on any Quality Assurance Project Plan (QAPP) developed before starting field activities.

NOTE: Review the **General PFAS Sampling Guidance** document prior to reviewing this guidance document.

This guidance assumes staff have a basic understanding of residential well sampling procedures. If you are a homeowner or resident interested in sampling your own well, please see the separate document **For Residents – Residential Well PFAS Sampling Guidance**.

EGLE intends to update the information contained within this Residential Well PFAS Sampling Guidance document as new information becomes available. The user of this Residential Well PFAS Sampling Guidance is encouraged to visit the Michigan PFAS Action Response Team (MPART) webpage (Michigan.gov/PFASResponse) to access the most current version of this document.

PFAS has been detected in groundwater in Michigan from residential wells with concentrations from non-detect to over 60,000 parts per trillion (ppt). Many commercial laboratories have low PFAS reporting limits of about 2 ppt. Therefore, there is a high potential of false positives if proper procedures are not followed during sample collection.

This Residential Well PFAS Sampling Guidance discusses the potential for cross contamination that can occur from:

- Field clothing and personal protective equipment (PPE)
- Sampling equipment
- Sample collection and handling
- Sample shipment

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NOTE: Additional information about PFAS testing can be found on the Michigan PFAS Response website:

[Michigan.gov/PFASResponse](https://www.michigan.gov/PFASResponse)

1. Typical Well Construction

There are several different types of drinking water well construction methods found in Michigan—rotary drilling, cable tool, auger drilling, hand driving, jetting, hollow-rod and dug wells. Well construction does not affect sampling methods but may provide additional insight into the meaning of the results.

Before sampling, staff should obtain the well construction record through the EGLE’s statewide groundwater database, Wellogic (<https://secure1.state.mi.us/wellogic>), or by contacting the local health department. Records for wells constructed since the year 2000 are typically located in Wellogic. Older well records may be found in the Scanned Water Well Record Retrieval System (see link in Wellogic). The well record will indicate the drilling method, well depth, type of formations encountered, grout (present or absent), type of pumping equipment, and more.

2. Potential Sources for PFAS Cross Contamination

Potential sources for PFAS cross contamination include sampling equipment, field clothing, personal protective equipment (PPE), sun and insect repellent, personal hygiene and personal care products (PCP), and food packaging. A high-level summary of PFAS cross contamination is presented in this guidance; however, a more detailed discussion can be found in the **General PFAS Sampling Guidance** document and should be read before continuing on with this document.

All the items and materials discussed in each of EGLE’s PFAS Sampling Guidance Documents are divided into three major groups:

- Prohibited (●) identifies items and materials that should not be used when sampling. It is well documented that they contain PFAS or that PFAS are used in their manufacture.
- Allowable (■) identifies items and materials that have been proven not to be sources of PFAS cross contamination and are considered acceptable for sampling.
- Needs Screening (▲) identifies items and materials that have the potential for PFAS cross contamination due to a lack of scientific data or statements from manufacturers to prove otherwise. These items and materials are further sub-divided into two categories:
 - **Category 1:** Items and materials that will come in direct contact with the sample. These should not be used when sampling unless they are known to be PFAS-free by collecting an equipment blank sample prior to use.
 - **Category 2:** Items and materials that will not come in direct contact with the sample. These should be avoided, if possible, unless they are known to be PFAS-free by collecting an equipment blank sample prior to use.

A general overview of PFAS contamination sources during sampling can be found in **Section 4.2** of the **General PFAS Sampling Guidance**. Any items or materials utilized that are not identified in this guidance or not discussed in **Section 4.2** should be evaluated as described in **Section 4.2.1**.

Sampling staff should take practical and appropriate precautions to avoid items that are likely to contain PFAS at the sampling site, as well as avoid specific items during the sampling event.

2.1 Field Clothing, Personal Protection Equipment (PPE), and Residential Well Sampling Materials and Equipment

Materials, field clothing, and equipment screening should be performed during the QAPP development or the planning phase of sampling programs. The screening should be performed on all items and materials that are expected to come into contact with the samples. Due to the extensive use of PFAS in many products, some PPE may contain PFAS. *However, the safety of staff is our primary concern and should not be compromised by fear of PFAS-containing materials without any scientific basis. Any deviation from this guidance, including those necessary to ensure the health and safety of sampling personnel, should be recorded in field notes and discussed in the final report.*

Section 4.2.4 of the General PFAS Sampling Guidance lists approved field clothing. As with any field mobilization, it is the responsibility of all staff to be aware of the physical, chemical, and biological hazards associated with a site. Personal safety is paramount. Any deviation from this guidance, including those necessary to ensure the health and safety of sampling personnel, should be recorded in field notes and discussed in the final report. A **Quick Reference Field Guide** can also be found on the Michigan PFAS Response website: Michigan.gov/PFASResponse.

NOTE: Special attention should be given to clothing that has been advertised as having waterproof, water-repellant, or dirt and/or stain repellant characteristics. They are likely to contain PFAS.

Do not use any equipment that contains any known fluoropolymers including, but not limited to:

- Polytetrafluoroethylene (PTFE) that includes the trademarks Teflon® and Hostaflon®.
- Polyvinylidene fluoride (PVDF) that includes the trademark Kynar®.
- Polychlorotrifluoroethylene (PCTFE) that includes the trademark Neoflon®.
- Fluorinated ethylene propylene (FEP) that includes the trademarks Teflon® FEP, Hostaflon® FEP, and Neoflon® FEP.
- Ethylene-tetrafluoro-ethylene (ETFE) that includes the trademark Tefzel®.

- Do not use low-density polyethylene (LDPE) for any items that will come into **direct contact** with the sample media. LDPE can be found in many items, such as plastic bags, tubing, and containers, including some sample bottles.

▲ **However**, an item containing LDPE may be used if it is known to be PFAS-free. LDPE as a raw material does not contain PFAS, but cross-contamination during manufacturing can occur.

NOTE: Manufacturers can change the chemical composition of any product. As a result, all items and materials that will come into direct contact with the sample media should be tested to confirm they are “PFAS-free”, i.e. will not contaminate samples at detectable levels. **There is no guarantee that materials in the “Allowable” category will always be PFAS-free.**

Staff should follow the **EGLE PFAS Sampling Quick Reference Field Guide** table for approved and prohibited items for documenting and sampling residential wells for PFAS. The following materials or items are allowable:

- Items containing LDPE (e.g., Ziploc® storage bags) that **do not** come into direct contact with the sample media and do not introduce cross-contamination with samples may be used.

- Use materials that are either made of high-density polyethylene (HDPE), stainless steel, polypropylene, silicone, or acetate.
- Use PFAS-free bottles containing Trizma® preservative provided by the laboratory.
- Use powderless nitrile gloves.
- ▲ Latex gloves should be screened before use.

2.2 Personal Care Products (PCP)

Several sampling guidance documents recommend that personal hygiene and PCPs (e.g., cosmetics, shampoo and other hair products, sunscreens, dental floss, etc.) not be used prior to and on the day(s) of sampling because the presence of PFAS in these products has been documented (OECD, 2002; Fujii, 2013; Borg and Ivarsson, 2017). However, if EGLE’s sampling guidance documents are followed, these items should not come into contact with the sampling equipment or the sample being collected. As of the date of this sampling guidance, cross-contamination of samples due to the use of PCPs has not been documented during the collection of thousands of samples. Field personnel should be aware however, of the potential of cross-contamination if the sampling equipment or actual samples would come into contact with these products. The following precautions should be taken when dealing with personal hygiene or PCPs before sampling:

- Do not handle or apply PCPs in the sampling area.
- Do not handle or apply PCPs while wearing PPE that will be present during sampling.
- Move to the staging area and remove PPE if applying personal care products becomes necessary.
- Wash hands thoroughly after the handling or application of PCPs. When finished, put on a fresh pair of powderless nitrile gloves.

2.3 Food Packaging

PFAS has been used by the paper industry as a special protective coating against grease, oil, and water for paper and paperboards, including food packaging, since the late 1950s (Trier et al., 2018). PFAS application for food packaging includes paper products that come into contact with food such as paper plates, food containers, bags, and wraps (OECD, 2002). Prewrapped food or snacks (such as candy bars, microwave popcorn, etc.) must not be in the sampling and staging area during sampling due to PFAS contamination of the packaging. When staff requires a break to eat or drink, they should remove their gloves, coveralls, and any other PPE, if worn, in the staging area and move to the designated area for food and beverage consumption. When finished, staff should wash their hands and put on a fresh pair of powderless nitrile gloves at the staging area before returning to the sampling area.

- Do not handle, consume, or otherwise interact with pre-wrapped food or snacks, carry-out food, fast food, or other food items while on-site during sampling.
- Move to the staging area and remove PPE prior to leaving the sampling and staging areas if consuming food on site becomes necessary.

3. Residential Well Sample Collection and Handling Procedures

Obtain Sample Bottles – All bottles used for PFAS sampling must come from the laboratory that will be performing the PFAS analysis. Bottles used for sample collection should contain the preservative Trizma®.

Schedule the Sampling Visit – Before scheduling a sampling visit:

- Obtain a copy of the well record if available. Well records may be obtained through the on-line tool Wellogic or by contacting the local health department.

● - Prohibited ■ - Allowable ▲ - Caution

- Contact the well owner by telephone or send a postcard or letter to the owner on record's mailing address proposing a sample collection date and request that any loose pets be secured on the day of sample collection to protect staff. Provide staff with contact information if a different sampling day or special instructions are needed.
- If **investigatory** samples will be collected: If possible, inquire ahead of time about any treatment systems installed on the residential water system and/or ask the resident to bypass the treatment system on the day of sample collection. This is so staff can get a representative sample of the untreated water being produced by the well.

The typical residential well sample will either be collected from inside the residents' home or from an outside tap. The sample should not be taken from a hose. Gain access to the interior of the home, if possible, to identify any treatment systems such as in-line filtration, softening, iron removal, or other treatment systems before selecting the sample tap location. The choice of an appropriate sample tap depends on the purpose of the sample. For example, a **screening** sample may be collected from a location most likely to represent the water consumed by the resident. This type of sample may not represent the water produced by the well and, therefore, should not be utilized for an environmental investigation. Primary consideration for screening sample location should be the kitchen faucet; however, acceptable sample locations include a laundry sink, outside tap, or other commonly used distribution points-of-use within the home.

- ▲ Avoid using leaky or spraying faucets, if possible.
- ▲ When swivel or single lever faucets are used for sampling, please ensure that only cold water is used for flushing and sample collection.
- The sampling of residential wells in a known PFAS-impacted area should be selected in order from least to most contaminated well, if known.

Primary consideration for an **investigatory** sample should be a location as near to the well as possible and prior to treatment, such as a sample tap at the pressure tank. This may be one of the acceptable locations listed in the paragraph above, but only if it is representative of the water from the drinking water well. If there is no untreated tap available at the residence and the treatment system cannot be bypassed, consider utilizing the kitchen sink tap, bathroom faucet, or outside tap. Note on the sample request form if the sample was collected from a treated tap.

The sampling of irrigation wells might be required if the resident is using the water for gardening, for occasional drinking, or to better understand a PFAS plume.

- Do not collect the sample from any garden hose or other devices used for irrigation.
- The sample should be located as close to the well as possible.

Flush the Tap – USEPA Method 537.1, Section 8.2.2 states that the sampler open the tap and allow the system to flush until the water temperature has stabilized (approximately 3 to 5 minutes). Samples are collected from the flowing system after it has been flushed.

- Options for flushing include running water at the sample tap itself, at a nearby laundry sink, at another household sink or bathtub, flushing a toilet, opening the outside tap, or a combination of any of these taps.
- If an outside tap is used, collect flushed water in a bucket and dispose of the water in the yard.

Sample Collection – Careful planning must be done in advance of the sample collection to minimize the potential for cross contamination. Use powderless nitrile gloves during sample collection. Powderless nitrile

● - Prohibited ■ - Allowable ▲ - Caution

gloves should be changed frequently and at any time there is an opportunity for cross contamination of the sampling, including the following activities:

- Before sample collection.
- While handling any sample, including quality assurance/quality control (QA/QC) samples, such as field reagent blanks.
- Handling of any non-dedicated sampling equipment (equipment used for more than one specific location), contact with non-decontaminated surfaces, or when judged necessary by staff.

The following considerations should be taken during sample collection to prevent contamination:

- Dust and fibers must be kept out of sample bottles.
- Never set the cap down or let anything touch the rim of the bottle or inside the cap.
- Splashed drops of water from the sink or ground must be kept out of sample bottle.
- Do not let the sample bottle overflow; if the bottle overflows, the Trizma[®] preservative will be flushed out and may result in QC failure in the laboratory.
- Do not use markers other than Fine or Ultra-Fine point Sharpies[®], which have been proven to be PFAS-free.
- Use PFAS-free markers to label the empty sample bottle prior to or immediately after the sample collection. Allow the ink to dry completely before proceeding. Preprinted labels from the laboratory can also be used. After labelling, a recommended practice is to place the labeled container on the polyethylene bag used below.
- Ensure that the sample tap is protected from dust, dirt, and debris, and ensure the sample tap is not too close to the sink bottom or the ground so that splashing is avoided.
- Relevant notes should be taken, including the presence of Teflon[®] tape on the piping.
- A residential well sample should be collected from the cold water tap only.
- Whenever possible, note and remove any attachments from the taps including aerators, screens, washers, hoses, and water filters.
- Use HDPE or polypropylene sample bottles provided by the laboratory containing Trizma[®] preservative.
- Glass bottles or containers may be used if they are known to be PFAS-free. However, PFAS have been found to adsorb to glass, especially when the sample is in contact with the glass for a long period of time (e.g., being stored in a glass container). If the sample comes into direct contact with the glass for a short period of time (e.g., using a glass container to collect the sample, then transferring the sample to a non-glass sample bottle), the adsorption is minimal.
- Fill the bottle to the shoulder or neck, taking care to not flush out the Trizma[®] preservative.
- If the bottle has been over-filled, do not dump out any sample. Headspace is not a requirement.
- Cap the bottle, then gently agitate by hand until the preservative is dissolved. Do not reopen the bottle.
- Samples should be double bagged using resealable LDPE bags (e.g., Ziploc[®]).
- Prior to shipment, samples need to be chilled, and must not exceed 50° F (10°C) during the first 48 hours after collection. (USEPA Method 537.1).

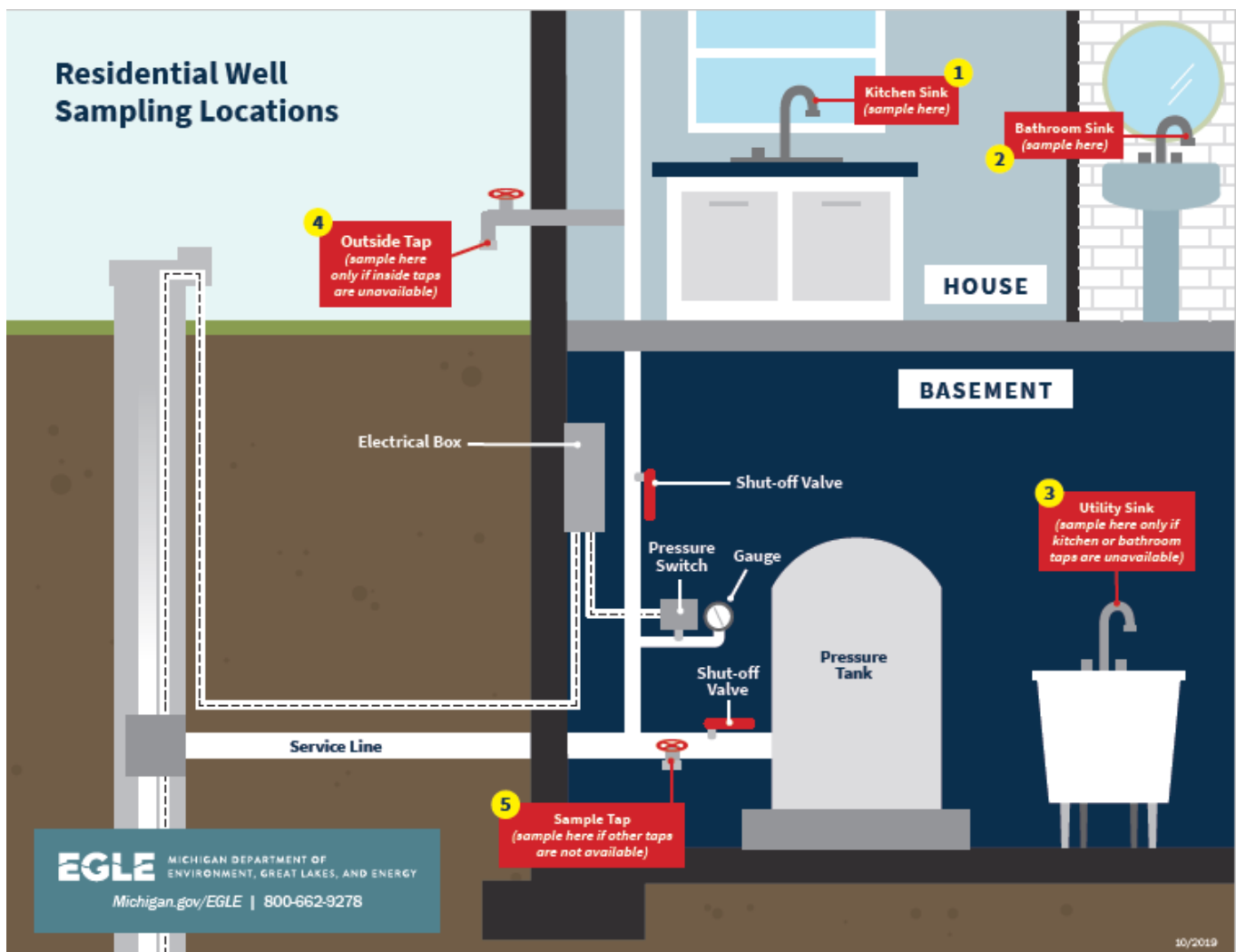
4. Sample Shipment

The following recommendations should be used for the sample shipment:

- Wet ice should be used to cool and maintain the sample at or below 50°F (10°C) during the first 48 hours after collection. (USEPA Method 537.1).

● - Prohibited ■ - Allowable ▲ - Caution

- ▲ Chemical or blue ice may be used if it is known to be PFAS-free and it is absolutely certain that the sample is cooled and maintained at or below 50°F (10°C) during collection and through transit to the laboratory. Chemical or blue ice should be frozen for at least 24 hours prior to use.
- Use wet ice that is double bagged using resealable LDPE bags (e.g., Ziploc®).
- Check the cooler periodically to ensure samples are well iced and at the proper temperature.
- Refresh with regular ice, if needed, double bagged in LDPE resealable storage bags (e.g., Ziploc®).
- Samples must be chilled **during shipment** and must not exceed 50°F (10°C) during the first 48 hours after collection. (USEPA Method 537.1).
- Chain of Custody (COC) should be single-bagged in resealable LDPE bags (e.g., Ziploc®) and taped to the inside of the cooler lid.
- The cooler should be taped closed with a custody seal and shipped by an overnight courier.
- Residential well samples should be shipped to the laboratory as soon as possible (e.g., overnight), so the laboratory may perform the necessary steps within the 14-day holding time beginning the date of sample collection (USEPA Method 537.1).



● - Prohibited ■ - Allowable ▲ - Caution

EGLE PFAS Sampling Quick Reference Field Guide¹
All Items Used During Sampling Event

● Prohibited
<ul style="list-style-type: none"> ● Items or materials that contain fluoropolymers such as <ul style="list-style-type: none"> ○ Polytetrafluoroethylene (PTFE), that includes the trademarks Teflon® and Hostaflon® ○ Polyvinylidene fluoride (PVDF), that includes the trademark Kynar® ○ Polychlorotrifluoroethylene (PCTFE), that includes the trademark Neoflon® ○ Ethylene-tetrafluoro-ethylene (ETFE), that includes the trademark Tefzel® ○ Fluorinated ethylene propylene (FEP), that includes the trademarks Teflon® FEP and Hostaflon® FEP ● Items or materials that contain any other fluoropolymer

Pumps, Tubing, and Sampling Equipment

● Prohibited	■ Allowable	▲ Needs Screening ²
<ul style="list-style-type: none"> ● Items or materials containing any fluoropolymer (potential items include tubing, valves, or pipe thread seal tape) 	<ul style="list-style-type: none"> ● High-density polyethylene (HDPE) ● Low-density polyethylene (LDPE) tubing ● Polypropylene ● Silicone ● Stainless steel ● Any items used to secure sampling bottles made from: <ul style="list-style-type: none"> ○ Natural rubber ○ Nylon (cable ties) ○ Uncoated metal springs ○ Polyethylene 	<ul style="list-style-type: none"> ● Any items or materials that will come into direct contact with the sample that have not been verified to be PFAS-free <ul style="list-style-type: none"> ○ Do not assume that any sampling items or materials are PFAS-free based on composition alone

Sample Storage and Preservation

● Prohibited	■ Allowable	▲ Needs Screening ²
<ul style="list-style-type: none"> ● Polytetrafluoroethylene (PTFE): Teflon® lined bottles or caps 	<ul style="list-style-type: none"> ● Glass jars⁴ ● Laboratory-provided PFAS-Free bottles: <ul style="list-style-type: none"> ○ HDPE or polypropylene ● Regular wet ice ● Thin HDPE sheeting ● LDPE resealable storage bags (i.e. Ziploc®) that will not contact the sample media⁶ 	<ul style="list-style-type: none"> ● Aluminium foil⁴ ● Chemical or blue ice⁵ ● Plastic storage bags other than those listed as <ul style="list-style-type: none"> ■ Allowable ● LDPE bottles

Field Documentation

● Prohibited	■ Allowable	▲ Needs Screening ²
<ul style="list-style-type: none"> ● Clipboards coated with PFAS ● Notebooks made with PFAS treated paper ● PFAS-treated loose paper ● PFAS-treated adhesive paper products 	<ul style="list-style-type: none"> ● Loose paper (non-waterproof, non-recycled) ● Rite in the Rain® notebooks ● Aluminium, polypropylene, or Masonite field clipboards ● Ballpoint pens, pencils, and Fine or Ultra-Fine Point Sharpie® markers 	<ul style="list-style-type: none"> ● Plastic clipboards, binders, or spiral hard cover notebooks ● All markers not listed as <ul style="list-style-type: none"> ■ Allowable ● Post-It® Notes or other adhesive paper products ● Waterproof field books

Decontamination

● Prohibited	■ Allowable	▲ Needs Screening ²
<ul style="list-style-type: none"> ● Decon 90® ● PFAS-treated paper towels 	<ul style="list-style-type: none"> ● Alconox®, Liquinox®, or Citranox® ● Triple rinse with PFAS-free deionized water ● Cotton cloth or untreated paper towel 	<ul style="list-style-type: none"> ● Municipal water ● Recycled paper towels or chemically treated paper towels

Clothing, Boots, Rain Gear, and PPE

● Prohibited	■ Allowable	▲ Needs Screening ²
<ul style="list-style-type: none"> • New or unwashed clothing • Anything made of or with: <ul style="list-style-type: none"> ○ Gore-Tex™ or other water-resistant synthetics • Anything applied with or recently washed with: <ul style="list-style-type: none"> ○ Fabric softeners ○ Fabric protectors, including UV protection ○ Insect resistant chemicals ○ Water, dirt, and/or stain resistant chemicals 	<ul style="list-style-type: none"> • Powderless nitrile gloves • Well-laundered synthetic or 100% cotton clothing, with most recent launderings not using fabric softeners • Made of or with: <ul style="list-style-type: none"> ○ Polyurethane ○ Polyvinyl chloride (PVC) ○ Wax coated fabrics ○ Rubber/Neoprene ○ Uncoated Tyvek® 	<ul style="list-style-type: none"> • Latex gloves • Water and/or dirt resistant leather gloves • Any special gloves required by a QAPP • Tyvek® suits, clothing that contains Tyvek®, or coated Tyvek®

Food and Beverages

● Prohibited	■ Allowable
<ul style="list-style-type: none"> • No food should be consumed in the staging or sampling areas, including pre-packaged food or snacks. <ul style="list-style-type: none"> ■ If consuming food on-site becomes necessary, move to the staging area and remove PPE. After eating, wash hands thoroughly and put on new PPE. 	<ul style="list-style-type: none"> • Brought and consumed only outside the vicinity of the sampling area: <ul style="list-style-type: none"> ○ Bottled water ○ Hydration drinks (i.e., Gatorade®, Powerade®)

Personal Care Products (PCP) - for day of sample collection⁶

● Prohibited	■ Allowable	▲ Needs Screening ²
<ul style="list-style-type: none"> • Any PCPs⁶, sunscreen, and insect repellent applied in the sampling area. 	<p>PCPs⁶, sunscreens, and insect repellents applied in the staging area, away from sampling bottles and equipment followed by thoroughly washing hands:</p> <p>PCPs⁶:</p> <ul style="list-style-type: none"> • Cosmetics, deodorants/antiperspirants, moisturizers, hand creams, and other PCPs⁶ <p>Sunscreens:</p> <ul style="list-style-type: none"> • Banana Boat® for Men Triple Defense Continuous Spray Sunscreen SPF 30 • Banana Boat® Sport Performance Coolzone Broad Spectrum SPF 30 • Banana Boat® Sport Performance Sunscreen Lotion Broad Spectrum SPF 30 • Banana Boat® Sport Performance Sunscreen Stick SPF 50 • Coppertone® Sunscreen Lotion Ultra Guard Broad Spectrum SPF 50 • Coppertone® Sport High Performance AccuSpray Sunscreen SPF 30 • Coppertone® Sunscreen Stick Kids SPF 55 • L'Oréal® Silky Sheer Face Lotion 50 • Meijer® Clear Zinc Sunscreen Lotion Broad Spectrum SPF 50 • Meijer® Sunscreen Continuous Spray Broad Spectrum SPF 30 • Meijer® Clear Zinc Sunscreen Lotion Broad Spectrum SPF 15, 30 and 50 • Meijer® Wet Skin Kids Sunscreen Continuous Spray Broad Spectrum SPF 70 • Neutrogena® Beach Defense Water+Sun Barrier Lotion SPF 70 • Neutrogena® Beach Defense Water+Sun Barrier Spray Broad Spectrum SPF 30 • Neutrogena® Pure & Free Baby Sunscreen Broad Spectrum SPF 60+ 	<ul style="list-style-type: none"> • Products other than those listed as <ul style="list-style-type: none"> ■ Allowable

● - Prohibited ■ - Allowable ▲ - Needs Screening

	<ul style="list-style-type: none"> ● Neutrogena® UltraSheer Dry-Touch Sunscreen Broad Spectrum SPF 30 <p>Insect Repellents:</p> <ul style="list-style-type: none"> ● OFF® Deep Woods ● Sawyer® Permethrin 	
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¹ This table is not considered to be a complete listing of prohibited or allowable materials. All materials should be evaluated prior to use during sampling. The manufacturers of various products should be contacted in order to determine if PFAS was used in the production of any particular product.

² Equipment blank samples should be taken to verify these products are PFAS-free prior to use during sampling.

³ **For surface water foam samples:** LDPE storage bags may be used in the sampling of foam on surface waters. In this instance, it is allowable for the LDPE bag to come into direct contact with the sample media.

⁴ **For fish and other wildlife samples:** Depending on the project objectives, glass jars and aluminum foil might be used for PFAS sampling. PFAS has been found to bind to glass and if the sample is stored in a glass jar, a rinse of the jar is required during the sample analysis. PFAS are sometimes used as a protective layer for some aluminum foils. An equipment blank sample should be collected prior to any aluminum foil use.

⁵ Regular ice is recommended as there are concerns that chemical and blue ice may not cool and maintain the sample at or below 42.8°F (6°C) (as determined by EPA 40 CFR 136 – NPDES) during collection and through transit to the laboratory.

⁶ Based on evidence, avoidance of PCPs is considered to be precautionary because none have been documented as having cross-contaminated samples due to their use. However, if used, application of PCPs must be done at the staging area and away from sampling bottles and equipment, and hands must be thoroughly washed after the use of any PCPs prior to sampling.

Appendix D: MDEQ Wastewater PFAS Sampling Guidance



WASTEWATER PFAS SAMPLING

Guidance

Introduction

This guidance document contains the processes, decontamination procedures, and acceptable materials for sampling wastewater for per- and polyfluoroalkyl substances (PFAS). In addition, this guidance will be used to support the sampling objectives and procedures based on the Quality Assurance Project Plan (QAPP) developed prior to sampling activities.

NOTE: Sections 1-4 of the **General PFAS Sampling Guidance** should be reviewed prior to reviewing this guidance document.

The Michigan Department of Environmental Quality (DEQ) intends to update the information contained within this PFAS Sampling Guidance document as new information becomes available. The user of this PFAS Sampling Guidance is encouraged to visit the Michigan PFAS Action Response Team webpage (www.michigan.gov/PFASresponse) to access the current version of this document.

Because PFAS compounds can be analyzed at concentrations in the parts per trillion (ppt) range, precautions must be taken to prevent cross-contamination. Wastewater sampling may require the use of non-dedicated equipment (i.e., equipment used for sampling at multiple locations), such as stainless steel or glass beakers and dippers, which should be decontaminated prior to first use and between samples to avoid cross-contamination per **Section 3.1** of the **General PFAS Sampling Guidance**. Any disposable equipment must be known to be PFAS-free.

This wastewater sampling guidance document covers the collection of wastewater PFAS samples related to municipal and industrial discharges and storm water and contains methods to prevent cross-contamination that can occur from:

- Field clothing and personal protective equipment (PPE)
- Personal care products (PCPs)
- Food packaging
- Sampling equipment
- Equipment decontamination
- Sample collection and handling
- Sample shipment

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NOTE: Additional information about PFAS testing can be found on the Michigan PFAS Action Response Team (MPART) website:
www.michigan.gov/PFASresponse

1. Potential Sources for PFAS Cross-Contamination

Potential sources for PFAS cross-contamination include items and materials used within the sampling environment, such as sampling equipment, field clothing, personal protective equipment (PPE), sun and biological protection products, personal hygiene, personal care products (PCPs), and food packaging. A detailed discussion about potential sources for PFAS cross-contamination is included in the **General PFAS Sampling Guidance**, which should be reviewed before reading this document. However, a high-level summary is presented in this guidance.

All of the items and materials discussed in each of the MDEQ’s PFAS Sampling Guidance Documents are divided into three major groups:

- Prohibited (●) identifies items and materials that should not be used when sampling. It is well documented that they contain PFAS or that PFAS are used in their manufacture.
- Allowable (■) identifies items and materials that have been proven not to be sources of PFAS cross contamination and are considered acceptable for sampling.
- Needs Screening (▲) identifies items and materials that have the potential for PFAS cross-contamination due to a lack of scientific data or statements from manufacturers to prove otherwise. These items and materials are further sub-divided into two categories:
 - **Category 1:** Items and materials that will come in direct contact with the sample. These should not be used when sampling unless they are known to be PFAS-free, by collecting an equipment blank sample prior to use.
 - **Category 2:** Items and materials that will not come in direct contact with the sample. These should be avoided, if possible, unless they are known to be PFAS-free by collecting an equipment blank sample prior to use.

● - Prohibited ■ - Allowable ▲ - Needs Screening

Please note that at this time no published research is available that documents the use of various materials and effect on sample results. Therefore, a conservative approach is recommended, and the guidance is based on the collection of multiple environmental samples at various PFAS Sites. Sampling staff should take practical and appropriate precautions to avoid items that are likely to contain PFAS at the sampling site as well as avoid specific items during the sampling event.

A general overview of PFAS contamination sources during sampling can be found in **Section 4.2** of the **General PFAS Sampling Guidance**. Any items or materials utilized that are not identified in this guidance or not discussed in **Section 4.2** should be evaluated as described in **Section 4.2.1**.

Sampling staff should take practical and appropriate precautions to avoid items that are likely to contain PFAS at the sampling site as well as avoid specific items during the sampling event (see below).

1.1 Field Clothing and Personal Protective Equipment (PPE)

Prior to sampling, staff should refer to **Section 4.2.2** of the **General PFAS Sampling Guidance** for approved field clothing as well as any requirements in a Health and Safety Plan (HASP). As with any field mobilization, it is the responsibility of all personnel to be aware of the physical, chemical and biological hazards associated with a particular site. Personal safety is paramount. Any deviation from this guidance, including those necessary to ensure the health and safety of sampling personnel, should be recorded in field notes and discussed in the final report.

NOTE: Special attention should be given to clothing that has been advertised as having waterproof, water-repellant, or dirt and/or stain repellent characteristics. They are likely to contain PFAS.

Depending on the project objectives and sampling plan, the collection of wastewater samples could be as simple as a grab sample or as complex as a sample collected using automatic sampling equipment. If life jackets or waders are needed they should be made of PFAS-free materials.

NOTE: Life jackets may have protective coatings that contain PFAS.

However, if samples are collected upgradient of the field person, and the wastewater sample is not expected to come into contact with the life jackets or waders, these could be considered

Category 2 items.

- Do not use waders made of Gore-Tex® or other known PFAS containing materials.
- Life jackets made of polyethylene foam and nylon shell fabric may be used.
- Waders made of Neoprene or other PFAS-free materials may be used.

Specific sunscreens that have been tested and found to be PFAS-free include:

- Banana Boat® for Men Triple Defense Continuous Spray Sunscreen SPF 30
- Banana Boat® Sport Performance Coolzone Broad Spectrum SPF 30
- Banana Boat® Sport Performance Sunscreen Lotion Broad Spectrum SPF 30
- Banana Boat® Sport Performance Sunscreen Stick SPF 50
- Coppertone® Sunscreen Lotion Ultra Guard Broad Spectrum SPF 50
- Coppertone® Sport High Performance AccuSpray Sunscreen SPF 30
- Coppertone® Sunscreen Stick Kids SPF 55
- L'Oréal® Silky Sheer Face Lotion 50+
- Meijer® Clear Zinc Sunscreen Lotion Broad Spectrum SPF 50
- Meijer® Sunscreen Continuous Spray Broad Spectrum SPF 30
- Meijer® Sunscreen Lotion Broad Spectrum SPF 15

● - Prohibited ■ - Allowable ▲ - Needs Screening

- Meijer® Sunscreen Lotion Broad Spectrum SPF 30
- Meijer® Wet Skin Kids Sunscreen Continuous Spray Broad Spectrum SPF 70
- Neutrogena® Beach Defense Water + Sun Barrier Lotion SPF 70
- Neutrogena® Beach Defense Water + Sun Barrier Spray Broad Spectrum SPF 30
- Neutrogena® Pure & Free Baby Sunscreen Broad Spectrum SPF 60+
- Neutrogena® UltraSheer Dry-Touch Sunscreen Broad Spectrum SPF 30

1.2 Personal Care Products (PCPs)

A number of sampling guidance documents recommend that personal hygiene and personal care products (PCPs) (e.g., cosmetics, shampoo, sunscreens, dental floss, etc.) not be used prior to and on the day(s) of sampling because the presence of PFAS in these products has been documented (OECD, 2002, Fujii, 2013, Borg and Ivarsson, 2017). However, if the MDEQ's sampling SOPs are followed, these items should not come into contact with the sampling equipment or the sample being collected. As of the date of this sampling guidance, cross-contamination of samples due to the use of PCPs has not been documented during the collection of thousands of samples. However, field personnel should be aware of the potential of cross-contamination if the sampling equipment or actual samples would come into contact with these products. The following precautions should be taken when dealing with personal hygiene or PCPs before sampling:

- Do not handle or apply PCPs in the sampling area.
- Do not handle or apply PCPs while wearing PPE that will be present during sampling.
- Move to the staging area and remove PPE if applying personal care products becomes necessary.
- Wash hands thoroughly after the handling or application of PCPs and, when finished, put on a fresh pair of powderless nitrile gloves.

1.3 Food Packaging

PFAS has been used by the paper industry as a special protective coating against grease, oil, and water for paper and paperboards, including food packaging since the late 1950s (Trier et al., 2018). PFAS application for food packaging includes paper products that come into contact with food such as paper plates, food containers, bags, and wraps (OECD, 2002). Pre-wrapped food or snacks (such as candy bars, microwave popcorn, etc.) must not be in the sampling and staging areas during sampling due to PFAS contamination of the packaging. When staff requires a break to eat or drink, they should remove their gloves, coveralls, and any other PPE, if worn, in the staging area and move to the designated area for food and beverage consumption. When finished, staff should wash their hands and put on a fresh pair of powderless nitrile gloves at the staging area, before returning to the sampling area.

- Do not handle, consume, or otherwise interact with pre-wrapped food or snacks, carry-out food, fast food, or other food items while on-site during sampling.
- Move to the staging area and remove PPE prior to leaving the sampling and staging areas if consuming food on site becomes necessary.

2. Sampling Equipment

Sampling equipment that falls into Category 1 or 2 are presented below:

Category 1: Any item that will directly contact the wastewater, including various wastewater samplers, tubing, sample bottles, etc. These items should be known to be PFAS-free prior to use.

NOTE: As a precautionary action, for **Category 1** sampling materials, an equipment rinsate blank should be collected even if the sampling materials are made of materials that are not expected to contain PFAS.

Category 2: Any item that will not directly contact the wastewater, including GPS receivers, notebooks, and clipboards. Although these items will not directly contact wastewater samples, the surface of some of these materials might contain PFAS and cross-contamination may still occur. Every effort should be made to ensure these items are PFAS-free. Be aware, surfaces of this field equipment or the containers in which they are kept may contain PFAS. Care should be taken to prevent cross-contamination in these cases.

Do not use any equipment that contains any known fluoropolymers including, but not limited to:

- Polytetrafluoroethylene (PTFE), that includes the trademarks Teflon® and Hostafion®.
- Polyvinylidene fluoride (PVDF), that includes the trademark Kynar®.
- Polychlorotrifluoroethylene (PCTFE), that includes the trademark Neoflon®.
- Fluorinated ethylene propylene (FEP), that includes the trademarks Teflon® FEP, Hostafion® FEP, and Neoflon® FEP.
- Ethylene-tetrafluoro-ethylene (ETFE), that includes the trademark Tefzel®.

Items that may contain fluoropolymers such as those listed above include, but are not limited to hose and pipe lining, tubing, cables and wires, films/coatings on aluminum, galvanized or aluminized steel, valves, seals, and gaskets.

- Do not use items containing low density polyethylene (LDPE) that will come into **direct contact** with the sample media. LDPE can be found in many items such as plastic bags, tubing, and containers, including some sample bottles.
 - ▲ **However**, an item containing LDPE may be used if it is known to be PFAS-free. LDPE as a raw material does not contain PFAS, but cross-contamination during manufacturing can occur.
- Items containing LDPE (e.g. Ziploc® storage bags) that **do not** come into direct contact with the sample media and do not introduce cross-contamination with samples may be used.
- Keep tubing in the original cardboard or bag in which it was shipped.
- Store tubing in a clean location free of dust and fibers.

NOTE: Manufacturers can change the chemical composition of any product. As a result, all materials that will come into direct contact with the sample media (defined as Category 1) should be tested to confirm they are “PFAS-free”, i.e. will not contaminate samples at detectable levels. **There is no guarantee that materials in the ‘Allowable category will always be PFAS-free.**

3. Sampling Methods

Wastewater sample collection can be divided into two methods: grab and automatic sampling.

3.1 Grab Sampling

Grab sampling is used to collect wastewater samples directly into the sample container from locations that are easily accessible. Grab sampling is preferred.

● - Prohibited ■ - Allowable ▲ - Needs Screening

Various types of immersion sampling equipment are available for wastewater sampling, including extension rods that can be used to immerse the laboratory sample bottle, beakers, and peristaltic pumps with tubing that extends into the wastewater.

The most common extension rods are telescoping or swing samplers. Both of these types of rods are similar in design and concept; the rods facilitate the immersion of either the sampling bottle, beaker, or scoop. Examples of extension rod designs include:

- Pendulum or angular beaker
- Fixed scoop
- Fixed or rotatable head bottle holder

NOTE: PFAS are expected to accumulate at the air/water interface. Unless specifically required in the QAPP, it is not advisable to collect samples from the very top layer of any wastewater, as it is not representative of the bulk wastewater.

A peristaltic pump can also be used with extension rods by attaching the tubing to the extension rods and immersing both the rod and the connected tubing to the desired depth in the wastewater.

- Cable ties used to secure the sample bottle should be made of natural rubber or nylon or uncoated metal springs.
- Use only sample collection bottles, tubing, beakers, and/or scoop materials that are known to be PFAS-free such as stainless steel, high-density polyethylene (HDPE), polypropylene, polyvinyl chloride (PVC), or silicone.
- Use only extension rods made of materials that are known to be PFAS-free, such as uncoated aluminum and steel.
- Glass bottles or containers may be used if they are known to be PFAS-free, however, PFAS have been found to adsorb to glass, especially when the sample is in contact with the glass for a long period of time (e.g. being stored in a glass container). If the sample comes into direct contact with the glass for a short period of time (e.g. using a glass container to collect the sample, then transferring the sample to a non-glass sample bottle), the adsorption is minimal.

3.2 Automatic Sampling

Automatic sampling equipment is used to collect either composite samples during a defined time interval or discrete samples at defined times without the presence of a technician. Automatic sampling should be avoided due to the increased potential for cross-contamination. It should only be used if a representative sample cannot otherwise be collected.

Typical automatic sampling equipment includes:

- A strainer used to strain large solids and avoid plugging of the equipment; the strainer is typically weighted to keep the suction line (i.e. tubing) at the desired depth and location;
- Suction line made of a flexible tubing that is run through a peristaltic pump;
- Distribution nozzle made of flexible tubing that discharges the sample into the sample bottle; and
- Sample bottle which is used for sample collection.

NOTE: The strainer should be decontaminated or replaced between each sampling event. The suction line, distribution nozzle and sample bottle should always be replaced between each sampling event.

The items and materials described above are **Category 1**; therefore, the following apply:

- Do not use any items or materials that are suspected or known to contain PFAS;
- Use stainless-steel couplings; and
- Use sampling materials (e.g., sample bottle, tubing, strainer, etc.) made of HDPE, polypropylene, silicone, PVC, or other materials known to be PFAS-free.

4. Equipment Decontamination

Disposable **Category 1** sampling equipment should be used, especially for sample bottles and tubing that are used in automatic samplers where the wastewater sample may be in contact with the sampling equipment for an extended period of time. Field sampling equipment used at multiple sites or sampling locations can become highly contaminated with PFAS. Decontamination procedures should be implemented to prevent cross-contamination, especially between individual sample locations.

For non-dedicated **Category 1** sampling equipment, the following materials and procedures should be used for decontamination:

- Do not use Decon® 90.
- Laboratory supplied PFAS-free deionized water is preferred for decontamination.
- Alconox®, Liquinox®, and Citranox® may be used for equipment decontamination.
- Sampling equipment can be scrubbed using a polyethylene or PVC brush to remove particulates.
- Decontamination procedures should include triple rinsing with PFAS-free water.
- Commercially available deionized water in an HDPE container may be used for decontamination if the water and container are known to be PFAS-free.
- ▲ Municipal drinking water may be used for decontamination purposes if it is known to be PFAS-free.

5. Sample Collection and Handling

The following should be observed for sample collection:

- Dust and fibers must be kept out of sample bottles.
- The sample cap should never be placed directly on the ground during sampling. If sampling staff must set the sample bottle cap down during sample collection and a second member of the sampling crew (wearing a fresh pair of powderless nitrile gloves) is not available, set the cap on a clean surface (cotton sheeting, HDPE sheeting, triple rinsed cooler lid, etc.).
- Do not insert or let tubing or any items or materials inside the sample bottle.
- Do not sample without powderless nitrile gloves.
- Regular/thick size markers (Sharpie® or otherwise) are to be avoided; as they may contain PFAS.
- Fine and Ultra-Fine Point Sharpie® markers are acceptable.
- Ballpoint pens may be used when labeling sample containers. If ballpoint pens do not write on the sample container labels, preprinted labels from the laboratory may be used.
- Hands should be well washed and gloved.
- Use HDPE or polypropylene sample bottles with Teflon®-free caps, provided by the laboratory.
- Commercially bought sample bottles used with automatic sampling equipment should be decontaminated prior to sampling and equipment blank samples should be collected using laboratory supplied PFAS-free water.
- Bottles should only be opened immediately prior to sampling.
- Bottles should be capped immediately after collecting the sample.

● - Prohibited ■ - Allowable ▲ - Needs Screening

- Samples should be double bagged using LDPE resealable storage bags.
- In the absence of a United States Environmental Protection Agency (USEPA) approved method, staff should contact the laboratory performing the sample analysis to obtain values for thermal preservation and holding time consistent with the analytical method to be used. At a minimum, samples should be placed on ice within 15 minutes of collection and chilled to a temperature of $\leq 42.8^{\circ}\text{F}$ (6°C) (as determined by EPA 40 CFR 136 – NPDES). This temperature should be maintained during collection and through transit to the laboratory.
- Glass bottles or containers may be used if they are known to be PFAS-free, however, PFAS has been found to adsorb to glass, especially when the sample is in contact with the glass for a long period of time (e.g. being stored in a glass container). If the sample comes into direct contact with the glass for a short period of time (e.g. using a glass container to collect the sample, then transferring the sample to a non-glass sample bottle), the adsorption is minimal.

NOTE: Currently, there are no USEPA-approved methods for PFAS analysis of wastewater. You may use either ASTM D7979 or an isotope dilution method. Either of these methods is a scan for a list of PFAS that the particular laboratory chooses to analyze. All PFAS analytes found on the DEQ PFAS Minimum Laboratory Analyte List are required to be reported for any PFAS samples collected by MDEQ staff or their contractors. The PFAS Minimum Laboratory Analyte List can be found at www.michigan.gov/PFASresponse.

If site specific information is available, sampling should be conducted from the least to the most contaminated location. Additional guidance on the sampling sequence can be found in Section 4.3.3 of the **General PFAS Sampling Guidance**.

If possible, collect PFAS samples prior to collecting non-PFAS samples or field parameters (pH, temperature, etc.).

Powderless nitrile gloves should be changed any time there is an opportunity for cross-contamination during sampling, including, but not limited to:

- Immediately prior to sample collection
- Each time sampling equipment is placed in and removed from wastewater (e.g., various wastewater samplers, water quality meter, turbidity meter, pump, tubing, etc.)
- Placing sampling tubing into the wastewater
- Handling of any sample, including quality assurance/quality control (QA/QC) samples
- After the handling of any non-dedicated sampling equipment
- After contact with non-decontaminated surfaces
- After decontamination of sampling equipment
- When judged necessary by field personnel

6. Sample Shipment

The following procedures should be used for sample shipment:

- Regular ice should be used to cool and maintain the sample at or below 42.8°F (6°C).
 - ▲ Chemical or blue ice may be used if it is known to be PFAS-free and it is absolutely certain that the sample is cooled and maintained at or below 42.8°F (6°C) during collection and through transit to the laboratory.
 - Check the cooler periodically to ensure samples are well iced and at the proper temperature.
- - Prohibited ■ - Allowable ▲ - Needs Screening

- Refresh with regular ice, if needed, double bagged in LDPE resealable storage bags if needed.
- Chain of Custody and other forms should be single bagged in LDPE resealable storage bags and taped to the inside of the cooler lid.
- The cooler should be taped closed with a custody seal and shipped by overnight courier.
- Samples should be shipped as soon as possible (e.g. overnight) to ensure the samples arrive within the analytical holding time specified by the lab.

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Appendix E: MDEQ Soil PFAS Sampling Guidance



SOIL PFAS SAMPLING

Guidance

Introduction

This guidance document discusses the processes, decontamination procedures, and acceptable items and materials for sampling soil for per- and polyfluoroalkyl substances (PFAS). In addition, this guidance will be used to support the sampling objectives and procedures based on any Quality Assurance Project Plan (QAPP) developed prior to sampling activities. This guidance assumes staff has basic familiarity with and/or understanding of basic soil sampling procedures.

NOTE: Review the General PFAS Sampling Guidance prior to reviewing this guidance document.

The Michigan Department of Environmental Quality (DEQ) intends to update the information contained within this PFAS Sampling Guidance document as new information becomes available. The user of this PFAS Sampling Guidance is encouraged to visit the Michigan PFAS Action Response Team webpage (www.michigan.gov/PFASresponse) to access the current version of this document.

Because PFAS compounds can be analyzed at concentrations in the parts per trillion (ppt) range, precautions must be taken to prevent cross-contamination. Field sampling equipment, either rented or not, that is used at multiple sites or sampling locations (also described as non-dedicated equipment), could become highly contaminated with PFAS. If site-specific information is available, sampling should be conducted from the least to the most contaminated locations. Additional guidance on the sampling sequence can be found in **Section 4.3.3** of the **General PFAS Sampling Guidance**.

Soil sampling involves the use of non-dedicated equipment, such as scoops, trowels, shovels, augers and other drilling-related equipment, which could be a source of cross-contamination. Decontamination procedures outlined in this guidance document should be followed to avoid cross contamination and equipment should be verified as PFAS-free.

The site-specific quality assurance document will generally provide the following information:

- Sample collection objectives.
- Locations, number, and volume of samples.
- Types of chemical analyses.
- Specific quality control procedures.
- Additional sampling requirements, as necessary.

This soil sampling guidance document discusses the collection of surface and sub-surface soil samples for PFAS and methods to prevent cross-contamination that can occur from:

- Field clothing and personal protection equipment (PPE)
- Sampling equipment
- Equipment decontamination
- Sample collection and handling
- Sample shipment

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NOTE: Additional information about PFAS testing can be found on the Michigan PFAS Action Response Team (MPART) website:
www.michigan.gov/PFASresponse

1. Potential Sources for PFAS Cross-Contamination

Potential sources for PFAS cross-contamination include items and materials used within the sampling environment, such as sampling equipment, field clothing, personal protective equipment (PPE), sun and biological protection products, personal hygiene, personal care products (PCPs), and food packaging. A detailed discussion about potential sources for PFAS cross-contamination is included in the **General PFAS Sampling Guidance**, which should be reviewed before reading this document. However, a high-level summary is presented in this guidance.

All of the items and materials discussed in each of the MDEQ's PFAS Sampling Guidance Documents are divided into three major groups:

- Prohibited (●) identifies items and materials that should not be used when sampling. It is well documented that they contain PFAS or that PFAS are used in their manufacture.
- Allowable (■) identifies items and materials that have been proven not to be sources of PFAS cross contamination and are considered acceptable for sampling.
- Needs Screening (▲) identifies items and materials that have the potential for PFAS cross-contamination due to a lack of scientific data or statements from manufacturers to prove otherwise. These items and materials are further sub-divided into two categories:
 - **Category 1:** Items and materials that will come in direct contact with the sample. These should not be used when sampling unless they are known to be PFAS-free, by collecting an equipment blank sample prior to use.
 - **Category 2:** Items and materials that will not come in direct contact with the sample. These should be avoided, if possible, unless they are known to be PFAS-free by collecting an equipment blank sample prior to use.

Please note that at this time no published research is available that documents the use of various materials and effect on sample results. Therefore, a conservative approach is recommended, and the guidance is based on the collection of multiple environmental samples at various PFAS Sites. Sampling staff should take practical and appropriate precautions to avoid items that are likely to contain PFAS at the sampling site as well as avoid specific items during the sampling event.

A general overview of PFAS contamination sources during sampling can be found in **Section 4.2** of the **General PFAS Sampling Guidance**. Any items or materials utilized that are not identified in this guidance or not discussed in **Section 4.2** should be evaluated as described in **Section 4.2.1**.

Sampling staff should take practical and appropriate precautions to avoid items that are likely to contain PFAS at the sampling site as well as avoid specific items during the sampling event (see below).

1.1 Field Clothing and Personal Protection Equipment (PPE)

A general overview of field clothing and PPE can be found in **Section 4.2.2** from the **General PFAS Sampling Guidance**. Materials, field clothing, and equipment screening should be performed during the QAPP development or the planning phase of sampling programs. The screening should be performed on all items and materials that are expected to come into contact with the samples and are defined as **Category 1**. This Soil Sampling Guidance assumes that the soil samples will be collected in an environment where only Level D protection (such as steel toe

NOTE: Both field clothing and PPE should be kept dust and fiber free.

● - Prohibited ■ – Allowable ▲ - Needs Screening

boots, eye protection, hardhat, etc.) is required by the Health and Safety Plan (HASP). During a PFAS investigation, PPE that contains PFAS should be avoided to prevent cross-contamination.

As with any field mobilization, it is the responsibility of all personnel to be aware of the physical, chemical, and biological hazards associated with a particular site. Personal safety is paramount. Any deviation from this guidance, including those necessary to ensure the health and safety of sampling personnel, should be recorded in field notes and discussed in the final report. Any additional field clothing and/or PPE items that might be required for the soil sampling and not discussed in the Sampling Guidance should be evaluated as described in **Sections 4.2.1 and 4.2.2** of the **General PFAS Sampling Guidance**.

Field sampling during wet weather (e.g., rainfall and snow) should be conducted while wearing the proper field clothing.

- Dust and fibers must not be allowed to collect on field clothing or PPE.
- Do not use clothing that has been advertised as waterproof, dirt and/or stain repellent that has not been verified to be made of PFAS-free materials.
- Only use clothing/PPE that has been verified to be made of PFAS-free materials.

Powderless nitrile gloves should be changed frequently any time there is an opportunity for cross-contamination. See **Section 6** of this guidance for additional glove instructions.

1.2 Personal Care Products (PCPs)

A number of sampling guidance documents recommend that personal hygiene and personal care products (PCPs) (e.g., cosmetics, shampoo, sunscreens, dental floss, etc.) not be used prior to and on the day(s) of sampling because the presence of PFAS in these products has been documented (OECD, 2002, Fujii, 2013, Borg and Ivarsson, 2017). However, if the MDEQ's sampling SOPs are followed, these items should not come into contact with the sampling equipment or the sample being collected. As of the date of this sampling guidance, cross-contamination of samples due to the use of PCPs has not been documented during the collection of thousands of samples. However, field personnel should be aware of the potential of cross-contamination if the sampling equipment or actual samples would come into contact with these products.

The following precautions should be taken when dealing with personal hygiene or PCPs before sampling:

- Do not handle or apply PCPs in the sampling area.
- Do not handle or apply PCPs while wearing PPE that will be present during sampling.
- Move to the staging area and remove PPE if applying personal care products becomes necessary.
- Wash hands thoroughly after the handling or application of PCPs and, when finished, put on a fresh pair of powderless nitrile gloves.

1.3 Food Packaging

PFAS has been used by the paper industry as a special protective coating against grease, oil, and water for paper and paperboards, including food packaging since the late 1950s (Trier et al., 2018). PFAS application for food packaging includes paper products that come into contact with food such as paper plates, food containers, bags, and wraps (OECD, 2002). Pre-wrapped food or snacks (such as candy bars, microwave popcorn, etc.) must not be in the sampling and staging areas during

sampling due to PFAS contamination of the packaging. When staff requires a break to eat or drink, they should remove their gloves, coveralls, and any other PPE, if worn, in the staging area and move to the designated area for food and beverage consumption. When finished, staff should wash their hands and put on a fresh pair of powderless nitrile gloves at the staging area, before returning to the sampling area.

- Do not handle, consume, or otherwise interact with pre-wrapped food or snacks, carry-out food, fast food, or other food items while on-site during sampling.
- Move to the staging area and remove PPE prior to leaving the sampling and staging areas if consuming food on site becomes necessary.

2. Soil Sampling Equipment

Soil sampling equipment is categorized into **Category 1** and **Category 2**:

Category 1: Any item that will directly contact with the soil, including shovels, trowels, spoons, bowls, hand augers buckets and extensions, and augers and direct push equipment, including any split spoon or sampling barrels. This equipment has a high likelihood of cross-contamination occurring if the proper decontamination procedures are not followed. These items should be known to be PFAS free.

NOTE: As a precautionary action, an equipment rinsate blank should be collected even if the sampling materials are made of materials that are not expected to contain PFAS.

Category 2: Any item that will not directly contact the soil, including field books, Munsell® color charts, Post-It® Notes, aluminum foil, and recycled paper towels.

Although these items will not directly contact soil samples, cross-contamination may still occur. Every effort should be made to ensure these items are PFAS-free. Be aware that surfaces of this field equipment or the containers in which they are kept may contain PFAS.

Do not use any equipment that contains any known fluoropolymers or that potentially has been cross-contamination with PFAS such as, but not limited to:

- Do not use Polytetrafluoroethylene (PTFE) that includes the trademark Teflon® and Hostaflon®, which can be found in many items, including but not limited to the lining of some hoses and tubing, some wiring, certain kinds of gears, and some objects that require the sliding action of parts.
- Do not use Polyvinylidene fluoride (PVDF) that includes the trademark Kynar®, which can be found in many items, including but not limited to tubing, films/coatings on aluminum, galvanized or aluminized steel, wire insulators, and lithium-ion batteries.
- Do not use Polychlorotrifluoroethylene (PCTFE), that includes the trademark Neoflon®, which can be found in many items, including but not limited to valves, seals, gaskets, and food packaging.
- Do not use Ethylene-tetrafluoro-ethylene (ETFE) that includes the trademark Tefzel®, which can be found in many items, including but not limited to wire and cable insulation and covers, films for roofing and siding, liners in pipes, and some cable tie wraps.
- Do not use Fluorinated ethylene propylene (FEP), that includes the trademarks Teflon® FEP and Hostaflon® FEP,

NOTE: Manufacturers can change the chemical composition of any product. As a result, all materials that will come into contact with the sample matrices (defined as Category 1) should be tested to confirm they are “PFAS-free”, i.e. will not contaminate samples at detectable levels. **There is no guarantee that materials in the ‘Allowable’ category will always be PFAS-free.**

● - Prohibited ■ – Allowable ▲ - Needs Screening

and may also include Neoflon®, which can be found in many items, including but not limited to wire and cable insulation and covers, pipe linings, and some labware.

- Do not use low density polyethylene (LDPE) for any items that will come into **direct contact** with the sample media. LDPE can be found in many items, including but not limited to containers and bottles, plastic bags, and tubing.
 - ▲ **However**, LDPE may be used if an equipment blank has confirmed it to be PFAS-free. LDPE does not contain PFAS in the raw material but may contain PFAS cross-contamination from the manufacturing process.
- LDPE bags (e.g. Ziploc®) that **do not** come into direct contact with the sample media and do not introduce cross-contamination with samples may be used.
- Use items and materials that are either made of high density polyethylene (HDPE), polypropylene, silicone, or acetate.
- ▲ Post-It® Notes should be screened before use.

Staff should follow the **MDEQ PFAS Sampling Quick Reference Field Guide** table for approved and prohibited items for documenting and sampling residential wells for PFAS.

NOTE: Special care and consideration should be given to the field sampling equipment when stored and handled outside the site boundaries or between different sample locations.

Many times, the release of PFAS in the environment occurs concurrently with other chemicals. For example, the release of PFAS present in the aqueous film forming foam (AFFF) is generally associated with the release of flammable liquids, such as jet fuels. As a result, sampling soil for PFAS may occur within plumes of volatile organic compounds (VOCs). For staff protection, the use of a photoionization detector (PID) is recommended to measure VOCs that might be present in the soil. The PID used during PFAS sampling to screen for VOCs may be made of materials that contain PFAS. However, the PID is a **Category 2** field equipment item and will have a very low possibility of cross contamination.

3. Soil Sampling Methods

Soils are usually sampled to define the subsurface geology and presence of aquifers or aquitards (lithology), or to determine the presence or absence of contaminants—in this case, PFAS (chemical analysis).

3.1 Soil Sampling for Lithologic Description

Soil samples are collected to determine the lithologic and physical makeup of the sample (i.e.: clay, sand, gravel, brown, mottled, etc.). This is done to determine the subsurface geologic stratigraphy of the site and help identify possible aquifers and aquitards in the subsurface. Soil can be collected loose or cored.

3.1.1 Loose Soil Samples

A loose soil sample is usually obtained by auger or rotary drilling processes, where the process delivers loose drilled soil to the surface for collection and interpretation. In the auger drilling process, the auger flights deliver soil cuttings to the surface around the auger string. These soils can be collected by a shovel and bagged in LDPE bags (e.g. Ziploc) or piled for later lithologic analysis and entry into a geologic log.

3.1.2 Cored Soil Samples

A cored soil sample is collected with a coring type of mechanism in a way that preserves the soil structure. Most coring mechanisms consist of a steel core barrel with a clear plastic liner (use an acetate or other PFAS-free liner) into which the soil core enters. Once the core barrel is retrieved at the surface, this liner is removed and cut open. The soil core is then sliced open to reveal a clean face. This clean face is examined for lithology and structure.

3.2 Soil Sampling for Chemical Analysis

Soils collected for chemical analysis are usually collected by using the core soil sample method. The soil samples need to be as undisturbed as possible. The requirement of an undisturbed soil sample **excludes** the use of loose auger cuttings or rotary methods of soil collection.

During the soil sampling process, the soil sampling device is removed from the ground. The liner is removed and placed on the cutting board and opened using a liner cutting device. The soil sample is visually inspected, and observations recorded in the site field book. The core is cut open to reveal a "clean" face for sampling. This process avoids the possibility of picking up any contaminants that may have gotten smeared onto the soil surface as the soil core entered the liner.

4. Equipment Decontamination Before Sampling

It is customary with soil sampling that the equipment is decontaminated at the conclusion of the sampling event. If the previous user of the equipment is not known, and it is unclear how the equipment was handled—especially rental equipment—decontaminate the equipment prior to sampling.

Disposable **Category 1** sampling equipment should be used, especially for sample bottles and other materials that are used where the soil sample may be in contact with the sampling equipment for an extended period of time. Field sampling equipment used at multiple sites or sampling locations can become highly contaminated with PFAS. Decontamination procedures should be implemented to prevent cross-contamination, including between individual sample locations.

For non-dedicated **Category 1** sampling equipment, the following items, materials, and procedures should be used for decontamination:

- Do not use Decon 90®.
- Laboratory supplied PFAS-free deionized water is preferred for decontamination.
- Alconox®, Liquinox®, and Citranox® can be used for equipment decontamination.
- Sampling equipment can be scrubbed using a polyethylene or Polyvinyl chloride (PVC) brush to remove particulates.
- Decontamination procedures should include triple rinsing with PFAS-free water.
- Commercially available deionized water in an HDPE container may be used for decontamination if the water is verified to be PFAS-free.
- ▲ Municipal drinking water may be used for decontamination purposes if it is known to be PFAS-free.

NOTE: All samples should be collected using PFAS-free High-Density Polyethylene (HDPE), glass, or polypropylene bottles provided by the laboratory, with Teflon®-

5. Sample Collection and Handling

The following considerations should be observed for sample collection:

- Dust and fibers must be kept out of sample bottles.
- The sample cap should never be placed directly on the ground during sampling.
 - ▲ If sampling staff must set the sample bottle cap down during sample collection and a second member of the sampling crew (wearing a fresh pair of powderless nitrile gloves) is not available, set the cap on a clean surface (cotton sheeting, HDPE sheeting, triple rinsed cooler lid, etc.).
- Do not sample without powderless nitrile gloves.
- Regular size Sharpie® are to be avoided. Thicker markers may contain PFAS.
- Fine and Ultra-Fine point Sharpie® markers are acceptable.
- Ballpoint pens may be used when labeling sample containers. If ballpoint pens do not write on the sample container labels, preprinted labels from the laboratory may be used.
- Bottles should only be opened immediately prior to sampling.
- Hands should be well washed and gloved.
- Use HDPE, glass, or polypropylene sample bottles with Teflon®-free caps, provided by the laboratory.
- Glass bottles or containers may be used if they are known to be PFAS-free, however, PFAS have been found to adsorb to glass, especially when the sample is in contact with the glass for a long period of time (e.g. being stored in a glass container). If the sample comes into direct contact with the glass for a short period of time (e.g. using a glass container to collect the sample, then transferring the sample to a non-glass sample bottle), the adsorption is minimal.
- Commercially bought sample bottles used with automatic sampling equipment should be decontaminated prior to sampling and equipment blank samples should be collected using laboratory supplied PFAS-free water.
- Samples should be double bagged using resealable low density polyethylene (LDPE) bags (e.g., Ziploc®).
- Follow any guidance or requirements in the PFAS analytical reference method that will be used for testing samples, for sample collection, storage, preservation, and holding times.
- If a published testing method is not used, and in the absence of formal United States Environmental Protection Agency (USEPA) guidance for PFAS sample storage, the documentation in USEPA Method 537 Rev. 1.1 should be used as a guide for thermal preservation (holding temperature) and holding times for soil or other samples. Samples must be chilled during storage and shipment and must not exceed 50°F (10° C) during the first 48 hours after collection.
- ▲ Latex gloves should be screened before use.

NOTE: USEPA Method 537 Rev. 1.1 was developed for the analysis of finished drinking water samples only. It was not designed for soils or other matrices that could cause significant interferences to the method. Other analytical methods such as ASTM D7968-14 or D7968-17a may be better at resolving interferences in soil samples. These methods were developed specifically for other matrices such as soil and sediments.

If site-specific information is available, sampling should be conducted from the least to the most contaminated location. Additional guidance on the sampling sequence can be found in **Section 4.3.3** of the **General PFAS Sampling Guidance**.

If possible, collect PFAS samples prior to collecting non-PFAS samples or field parameters (pH, temperature, etc.).

● - Prohibited ■ – Allowable ▲ - Needs Screening

Powderless nitrile gloves should be changed any time there is an opportunity for cross-contamination during sampling, including, but not limited to:

- Immediately prior to sample collection
- Each time sampling equipment is placed in and then removed from soil at a new location
- Handling of any sample, including quality assurance/quality control (QA/QC) samples
- After the handling of any non-dedicated sampling equipment
- After contact with non-decontaminated surfaces
- After decontamination of sampling equipment
- When judged necessary by field personnel

6. Sample Shipment

The following procedures should be used for sample shipment:

- Regular ice should be used to cool and maintain the sample at or below 42.8°F (6°C).
 - ▲ Chemical or blue ice may be used if it is known to be PFAS-free and it is absolutely certain that the sample is cooled and maintained at or below 42.8°F (6°C) during collection and through transit to the laboratory.
- Check the cooler periodically to ensure samples are well iced and at the proper temperature.
- Refresh with regular ice, if needed, double bagged in LDPE resealable storage bags if needed.
- Chain of Custody and other forms should be single bagged in LDPE (e.g. Ziploc®) storage bags and taped to the inside of the cooler lid.
- The cooler should be taped closed with a custody seal and shipped by overnight courier.
- Samples should be shipped as soon as possible (e.g. overnight) to ensure the samples arrive within the analytical holding time specified by the lab.

7. Equipment Decontamination After Sampling

It is customary to decontaminate soil sampling equipment at the end of the sampling event, whether it is a single sampling location or the conclusion of the workday. This is to ensure sampling equipment is decontaminated ahead of time for the next sampling event.

- Do not put equipment away without decontaminating it.
- Do decontaminate sampling equipment after sampling at each location, or at the end of the workday. Follow the decontamination guidelines in **Section 4 (Equipment Decontamination Before Sampling)** of this document.

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Appendix F: MDEQ Surface Water PFAS Sampling Guidance



SURFACE WATER PFAS SAMPLING

Guidance

Introduction

This sampling guidance contains the processes, decontamination procedures, and acceptable items and materials for sampling surface water for Per- and Polyfluoroalkyl Substances (PFAS). This guidance will be used to support the sampling objectives and procedures based on the Quality Assurance Project Plan (QAPP) developed prior to any field activities. This guidance assumes staff has basic familiarity with and/or understanding of basic surface water sampling procedures.

NOTE: Review the **General PFAS Sampling Guidance** prior to reviewing this guidance document.

The Michigan Department of Environmental Quality (MDEQ) intends to update the information contained within this Surface Water PFAS Sampling Guidance document as new information becomes available. The user of this Surface Water PFAS Sampling Guidance is encouraged to visit the Michigan PFAS Action Response Team webpage (www.michigan.gov/PFASresponse) to access the current version of this document.

PFAS has been detected in surface water in Michigan at concentrations of over 19,000 parts per trillion (ppt). Because PFAS compounds can be analyzed at concentrations in the parts per trillion (ppt) range, precautions must be taken to prevent cross-contamination. Therefore, there is a high possibility of false positives if decontamination procedures are not followed diligently. This sampling guidance covers both the collection of samples from shallow and deep surface water bodies.

This Surface Water PFAS Sampling Guidance discusses the collection of surface water samples and methods to prevent cross-contamination that can occur from:

- Field clothing and personal protective equipment (PPE)
- Personal care products (PCPs)
- Food packaging
- Sampling equipment
- Equipment decontamination
- Filtering of surface water
- Sample collection and handling
- Sample shipment

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NOTE: Additional information about PFAS testing can be found on the Michigan PFAS Action Response Team (MPART) website:

www.michigan.gov/PFASresponse

1. Potential Sources for PFAS Cross-Contamination

Potential sources for PFAS cross-contamination include items and materials used within the sampling environment, such as sampling equipment, field clothing, personal protective equipment (PPE), sun and biological protection products, personal hygiene, personal care products (PCPs), and food packaging. A detailed discussion about potential sources for PFAS cross-contamination is included in the **General PFAS Sampling Guidance**, which should be reviewed before reading this document. However, a high-level summary is presented in this guidance.

All of the items and materials discussed in each of the MDEQ's PFAS Sampling Guidance Documents are divided into three major groups:

- Prohibited (●) identifies items and materials that should not be used when sampling. It is well documented that they contain PFAS or that PFAS are used in their manufacture.
- Allowable (■) identifies items and materials that have been proven not to be sources of PFAS cross contamination and are considered acceptable for sampling.
- Needs Screening (▲) identifies items and materials that have the potential for PFAS cross-contamination due to a lack of scientific data or statements from manufacturers to prove otherwise. These items and materials are further sub-divided into two categories:
 - **Category 1:** Items and materials that will come in direct contact with the sample. These should not be used when sampling unless they are known to be PFAS-free, by collecting an equipment blank sample prior to use.
 - **Category 2:** Items and materials that will not come in direct contact with the sample. These should be avoided, if possible, unless they are known to be PFAS-free by collecting an equipment blank sample prior to use.

● - Prohibited ■ – Allowable ▲ - Needs Screening

Please note that at this time no published research is available that documents the use of various materials and effect on sample results. Therefore, a conservative approach is recommended, and the guidance is based on the collection of multiple environmental samples at various PFAS Sites. Sampling staff should take practical and appropriate precautions to avoid items that are likely to contain PFAS at the sampling site as well as avoid specific items during the sampling event.

A general overview of PFAS contamination sources during sampling can be found in **Section 4.2** of the **General PFAS Sampling Guidance**. Any items or materials utilized that are not identified in this guidance or not discussed in **Section 4.2** should be evaluated as described in **Section 4.2.1**.

Sampling staff should take practical and appropriate precautions to avoid items that are likely to contain PFAS at the sampling site as well as avoid specific items during the sampling event (see below).

1.1 Field Clothing and Personal Protection Equipment (PPE)

A general overview of field clothing and PPE can be found in **Section 4** of the **General PFAS Sampling Guidance**.

As with any field mobilization, it is the responsibility of all personnel to be aware of the physical, chemical and biological hazards associated with a particular site. Personal safety is paramount. The safety of staff should not be compromised by fear of PFAS-containing materials without any scientific basis. Any deviation from this guidance, including those necessary to ensure the health and safety of sampling personnel, should be recorded in field notes and discussed in the final report.

Depending on the project objectives and sampling plan, the collection of surface water samples could be as simple as a grab sample or as complex as a sample collected using a Van Dorn® sampler from a boat. Generally, for surface water sampling, approved field clothing (discussed in **Section 4** of the **General PFAS Sampling Guidance**) is required. Life jackets made of PFAS-free materials should be used. The coatings used on waders are of particular concern during surface water sampling. Ensure the waders are made from PFAS-free materials before use.

- Do not use waders made of Gore-Tex or other known PFAS containing materials.
- Life jackets made of polyethylene foam and nylon shell fabric may be used.
- Waders made of Neoprene or other PFAS-free materials may be used.

NOTE: Special attention should be given to clothing that has been advertised as having waterproof, water-repellant, or dirt and/or stain characteristics. They are likely to have PFAS in their manufacturing.

NOTE: Life jackets may have protective coatings that contain PFAS.

Any field clothing and/or PPE items that might be required for surface water sampling and not discussed in this guidance should be evaluated as described in **Section 4.2.2** of the **General PFAS Sampling Guidance**.

Powderless nitrile gloves should frequently be changed any time there is an opportunity for cross-contamination of the sampling including, but not limited to, the following activities:

- Each time sampling equipment is handled.
- Prior to sample collection.

NOTE: Both field clothing and PPE should be kept dust and fiber free. During the sample collection, extra care should be taken so that no dust or fibers can fall into the sample bottle.

● - Prohibited ■ – Allowable ▲ - Needs Screening

- After handling any sample, including QA/QC samples such as field reagent blanks or equipment rinsate blanks.
- After the handling of any non-dedicated sampling equipment, contact with non-decontaminated surfaces, or when judged necessary by field personnel.
- During and after decontamination of non-dedicated sampling equipment.

1.2 Personal Care Products (PCPs)

A number of sampling guidance documents recommend that personal hygiene and personal care products (PCPs) (e.g., cosmetics, shampoo, sunscreens, dental floss, etc.) not be used prior to and on the day(s) of sampling because the presence of PFAS in these products has been documented (OECD, 2002, Fujii, 2013, Borg and Ivarsson, 2017). However, if the MDEQ's sampling SOPs are followed, these items should not come into contact with the sampling equipment or the sample being collected. As of the date of this sampling guidance, cross-contamination of samples due to the use of PCPs has not been documented during the collection of thousands of samples. However, field personnel should be aware of the potential of cross-contamination if the sampling equipment or actual samples would come into contact with these products. The following precautions should be taken when dealing with personal hygiene or PCPs before sampling:

- Do not handle or apply PCPs in the sampling area.
- Do not handle or apply PCPs while wearing PPE that will be present during sampling.
- Move to the staging area and remove PPE if applying personal care products becomes necessary.
- Wash hands thoroughly after the handling or application of PCPs and, when finished, put on a fresh pair of powderless nitrile gloves.

1.3 Food Packaging

PFAS has been used by the paper industry as a special protective coating against grease, oil, and water for paper and paperboards, including food packaging since the late 1950s (Trier et al., 2018). PFAS application for food packaging includes paper products that come into contact with food such as paper plates, food containers, bags, and wraps (OECD, 2002). Pre-wrapped food or snacks (such as candy bars, microwave popcorn, etc.) must not be in the sampling and staging areas during sampling due to PFAS contamination of the packaging. When staff requires a break to eat or drink, they should remove their gloves, coveralls, and any other PPE, if worn, in the staging area and move to the designated area for food and beverage consumption. When finished, staff should wash their hands and put on a fresh pair of powderless nitrile gloves at the staging area, before returning to the sampling area.

- Do not handle, consume, or otherwise interact with pre-wrapped food or snacks, carry-out food, fast food, or other food items while on-site during sampling.
- Move to the staging area and remove PPE prior to leaving the sampling and staging areas if consuming food on site becomes necessary.

2. Surface Water Sampling Equipment

Surface water sampling equipment that is also used for non-PFAS sampling such as dippers, Kemmerer[®], or Van Dorn[®] samplers, should be decontaminated prior to collecting PFAS samples to avoid cross contamination. This non-dedicated equipment (equipment used for more than one water body or location) should be verified that it is PFAS free at least once prior to use. Surface water sampling equipment can fall into **Category 1** or **Category 2**:

- - Prohibited
- – Allowable
- ▲ - Needs Screening

Category 1: Surface water sampling equipment that will come into contact with the surface water sample include sample bottles and various surface water samplers or tubing. Sample bottles should be provided by the laboratory and known to be PFAS free. Any surface water samplers, tubing, or materials that will come into contact with the surface water samples should be screened and known to be PFAS-free. The tubing should always be kept in the original cardboard or bag in which it was shipped. The tubing should always be stored in a clean location free of dust and fibers.

NOTE: As a precautionary action, an equipment rinsate blank should be collected even if the sampling materials are made of materials that are not expected to contain PFAS.

Category 2: Examples of field equipment that do **not** come into contact with the surface water samples include water quality meters, GPS receivers, notebooks, clipboards, and turbidity meters. The surface of some of these pieces of field equipment, or the storage boxes in which they are kept, might contain PFAS.

Do not use any equipment that contains any known fluoropolymers including, but not limited to:

- Do not use polytetrafluoroethylene (PTFE), that includes the trademark Teflon® and Hostaflon®, which can be found in many items, including but not limited to the lining of some hoses and tubing, some wiring, certain kinds of gears, and some objects that require the sliding action of parts.
- Do not use Polyvinylidene fluoride (PVDF), that includes the trademark Kynar®, which can be found in many items, including but not limited to tubing, films/coatings on aluminum, galvanized or aluminized steel, wire insulators, and lithium-ion batteries.
- Do not use Polychlorotrifluoroethylene (PCTFE), that includes the trademark Neoflon®, which can be found in many items, including but not limited to valves, seals, gaskets, and food packaging.
- Do not use Ethylene-tetrafluoro-ethylene (ETFE), that includes the trademark Tefzel®, which can be found in many items, including but not limited to wire and cable insulation and covers, films for roofing and siding, liners in pipes, and some cable tie wraps.
- Do not use Fluorinated ethylene propylene (FEP), that includes the trademarks Teflon® FEP and Hostaflon® FEP, and may also include Neoflon®, which can be found in many items, including but not limited to wire and cable insulation and covers, pipe linings, and some labware.
- Do not use low density polyethylene (LDPE) for any items that will come into **direct contact** with the sample media. LDPE can be found in many items, including but not limited to containers and bottles, plastic bags, and tubing.
 - ▲ **However**, LDPE may be used if an equipment blank has confirmed it to be PFAS-free. LDPE does not contain PFAS in the raw material but may contain PFAS cross-contamination from the manufacturing process.
 - LDPE bags (e.g. Ziploc®) that **do not** come into direct contact with the sample media and do not introduce cross contamination with samples may be used.
 - Use materials that are either made of high density polyethylene (HDPE), polypropylene, silicone, or acetate.
 - Use only powderless nitrile gloves (which can be found at some hardware and major retail outlets).
 - Keep tubing in the original cardboard or bag in which it was shipped.

Note: Manufacturers can change the chemical composition of any product. As a result, all materials that will come into direct contact with the sample media should be tested to confirm they are “PFAS-free”, i.e. will not contaminate samples at detectable levels. **There is no guarantee that materials in the ‘Allowable’ category will always be PFAS-free.**

● - Prohibited ■ – Allowable ▲ - Needs Screening

- Store tubing in a clean location free of dust and fibers.
- ▲ Latex gloves should be screened before use.
- ▲ Post-It® Notes should be screened before use.

NOTE: Depending on the project objectives, boats might be required to be used during surface water sampling. Boats might have various parts that may contain PFAS, including protective water repellent coatings. When boats are used on rivers, samples should always be collected on the upgradient side of the boat.

Depending on the project data quality objectives, water samples can be collected as: a simple grab directly into the sample bottle; a grab sample at a selected depth using any of several collection bottles with subsequent transfer to the sample bottle(s); or as a depth integrated sample. A depth integrated sample can be collected using a simple weighted bottle constructed to allow gradual water inflow (e.g., chlorophyll sampler), or by using a Van Dorn® or Kemmerer® sampler and compositing grab samples from several depths. Compositing samples are then transferred to the sample bottle.

Surface water sampling collection can be divided into two method categories as presented in the following Table 1.

Table 1. Surface Water Sampling Methods¹

Depth to Surface Water Sample	Locations	Sampling Method
0-5 feet	Streams, rivers, creeks, tributaries, lakes, lagoons, ponds, and impoundments.	Direct method, swing, telescoping, and Van Dorn, depth integrating samplers.
Over 5 feet	Large streams, rivers, tributaries, lakes, lagoons, ponds, and impoundments.	Peristaltic pump, swing, telescoping, Van Dorn, Kemmerer, and depth integrating samplers.

¹This table includes the most frequently used methods for surface water samples.

2.1 Container Immersion

Two types of immersion sampling equipment are available for surface water sampling: extension rods and submersible devices. Extension rods can be used to immerse the actual sample bottle, different types of beakers, or peristaltic pump tubing into the surface water. Submersible devices (i.e., Kemmerer Bottle, Van Dorn Sampler) are fully immersed into the surface water using a rope.

2.1.1 Extension Rods

The most common extension rods are telescoping or swing samplers. Both types of sampling equipment are very similar in design and concept, and both facilitate the immersion of either the sampling bottle or various beakers or scoops. Lists of various extension rod designs are provided below:

- Pendulum or angular beaker.
- Fixed scoop.
- Fix or rotatable head bottle holder.

A peristaltic pump can also be used with extension rods by attaching the tubing to the extension rods and immersing both the rods and the connected tubing to the desired depth in the surface water.

- Use only sample collection equipment, tubing, beakers, and/or scoop materials that are known to be PFAS-free such as stainless steel, glass, HDPE, polyvinyl chloride (PVC), or silicone.
- Extension rods made of materials such as aluminum that has been identified as being PFAS-free can be used.

A specialized extension rod that features a telescoping design for the handle could also be used as a subsurface grab sampler. The sample is collected using a cable from the handle, which has a ring that can be opened for the sample collection after the desired depth has been reached.

2.1.2 Submersible Devices

The most common submersible devices being used are Kemmerer Bottles or Van Dorn Samplers. These devices are primarily used when the samples are collected at depths greater than 5 feet from a boat and/or structure such as a bridge or pier. All submersible devices are submerged in the surface water using a rope.

NOTE: Careful evaluation of all submersible samplers' parts should be done. Any parts that might contain PFAS should be replaced with PFAS-free materials. Equipment rinsate blank samples should be collected to make certain the sampler is PFAS-free.

The Kemmerer Bottle sampler is typically constructed of a stainless-steel tube with polyurethane end seals that can collect a total sample volume of 1.2 liters. The Kemmerer Bottle is not ideal for the collection of samples close to the surface, as the tube is immersed vertically in the water.

The Van Dorn[®] bottle sampler is typically constructed of 1-liter transparent acrylic tube with two end stoppers. The sampler is suspended horizontally, which is ideal for the sample collection in shallow water bodies as well as sampling at depth.

When submersible samplers are used, the following recommendations should be followed:

- Do not use any sampling bottle with Teflon end seals.
- Use a Kemmerer[®] Bottle made of stainless steel with polyurethane end seals.
- Use a Van Dorn[®] bottle sampler that uses stoppers made of PFAS-free materials.
- Use nylon line, stainless steel cable, or line or wires made of PFAS-free materials for sample collection.
- Use tubing for the sampling ports made of HDPE, polypropylene, silicone, PVC, or other PFC-free materials.

2.2 Direct Sampling

For surface water samples collected near the shore (e.g., from streams, rivers, lakes, and other surface waters), the direct method can be used to collect the water samples directly into the sample container.

- Do not sample without powderless nitrile gloves.

● - Prohibited ■ – Allowable ▲ - Needs Screening

- Never place the sample cap directly on the ground or boat deck during sampling.
- Use powderless nitrile gloves
- Hands should be well washed
- Use HDPE sample bottles with Teflon®-free caps, provided by the laboratory.
- If sample bottles that are known to be PFAS-free are not available, the sample container and lid should be rinsed with water that is known to be PFAS-free at least 3 times prior to collecting the sample.
- If samples are collected while wading in the water body, the bottle should be immersed inverted and upstream of the collector.
- If samples are collected from a boat, the bottles should be submerged upstream of the boat.

NOTE: Unless specifically required by the project objectives, surface water samples should **not** be taken at the top layer of the water body or of surface scums. PFAS are expected to accumulate at the surface water air interface or be present in the surface runoff, so samples taken at the surface are likely to result in high biased results that are not representative of the bulk surface water.

3. Equipment Decontamination

Field sampling equipment that is used at multiple sites or sampling locations (non-dedicated equipment) could become contaminated with PFAS.

The following should be considered when decontaminating any equipment that contacts the sampling media:

- Do not use Decon 90®.
- Laboratory supplied PFAS-free deionized water is preferred for decontamination.
- Alconox®, Liquinox®, and Citranox® can be used for equipment decontamination.
- Sampling equipment can be scrubbed using a polyethylene or Polyvinyl chloride (PVC) brush to remove particulates.
- Decontamination procedures should include triple rinsing with PFAS-free water.
- Commercially available deionized water in an HDPE container may be used for decontamination if the water is verified to be PFAS-free.
- ▲ Municipal drinking water may be used for decontamination purposes if it is known to be PFAS-free.

4. Sample Collection and Handling

A preferred sampling sequence should be established prior to any sampling event to reduce the risk of cross contamination. In general, the sampling sequence should begin in areas expected or known to be least contaminated, proceeding to anticipated areas or identified to be most contaminated. If analytical results from past sampling events are available, the sampling sequence can be readily determined.

However, for many PFAS investigation sites, no PFAS sampling has been conducted. In these cases, all site information on possible PFAS uses and potential PFAS migration patterns (e.g., upgradient, downgradient) from PFAS sources at the site should be reviewed prior to the sampling event to help establish the sampling sequence.

If multiple samples (i.e., monitoring wells, surface water, residential) will be collected in an area where a PFAS release in the environment has been documented, samples that are known to be upgradient from the impacted area should be sampled first, followed by those that are furthest downgradient from the

suspected source. The remaining samples should be progressively sampled from the one most distant downgradient to those closer to the known PFAS source.

If no information is available about the site, samples are to be collected in the following order:

1. Drinking Water (e.g., residential wells)
2. Surface Water
3. Groundwater

When collecting and handling surface water samples:

- Do not insert or let tubing or any materials inside the sample bottle.
- Dust and fibers must be kept out of sample bottles.
- The sample cap should never be placed directly on the ground during sampling. If sampling staff must set the sample bottle cap down during sample collection and a second member of the sampling crew (wearing a fresh pair of powderless nitrile gloves) is not available, set the cap on a clean surface (cotton sheeting, HDPE sheeting, triple rinsed cooler lid, etc.).
- Regular/thick size markers (Sharpie® or otherwise) are to be avoided; as they may contain PFAS.
- Fine or Ultra-Fine point Sharpies® may be used to label the empty sample bottle while in the staging area provided the lid is on the sample bottle and powderless nitrile gloves are changed following sample bottle labeling.
- Ballpoint pens may be used when labeling sample containers. If ballpoint pens do not write on the sample container labels, preprinted labels from the laboratory may be used.
- Hands should be well washed and gloved.
- Use HDPE, or polypropylene sample bottles with Teflon®-free caps, provided by the laboratory.
- Bottles should only be opened immediately prior to sampling.
- Bottles should be capped immediately after collecting the sample.
- Samples should be double bagged using resealable low density polyethylene (LDPE) bags (e.g., Ziploc®).
- Follow any guidance or requirements in the PFAS analytical reference method that will be used for testing samples, for sample collection, storage, preservation, and holding times.

If a published testing method is not used, and in the absence of formal United States Environmental Protection Agency guidance for PFAS sample storage, the documentation in USEPA Method 537 Rev. 1.1 should be used as a guide for thermal preservation (holding temperature), and holding times for surface water or other samples. Samples must be chilled during storage and shipment, and must not exceed 50°F (10° C) during the first 48 hours after collection.

NOTE: USEPA Method 537 Rev. 1.1 was developed for the analysis of finished drinking water samples only. It was not designed for testing surface water or other matrices that could cause significant interferences to the method.

Surface water samples should be extracted as soon as possible but must be extracted within 14 days. Extracts must be stored at room temperature and analyzed within 28 days after extraction (EPA Method 537 Rev. 1.1).

5. Filtering of Surface Water

Since PFAS can adsorb to particulate matter, unfiltered samples may result in high-biased results. PFAS are known to adsorb to various filters. As a result, filtering of surface water samples prior to delivery to the lab should be avoided unless called for in the project data quality objectives. To reduce the need for filtering, samples should be collected with as minimal disturbance to sediments as possible.

If it is known beforehand that samples will need to be filtered the procedure should be discussed with the laboratory and sample handling methods and responsibilities should be described in the sampling workplan and QAPP.

The following recommendations should be used when considering filtering of the samples:

NOTE: It is recommended that filtering of the samples should **only be performed in the laboratory** in order to reduce the possibility of cross contamination.

- **Field filtration of the sample is generally not advised.**
 - ▲ If filtering is absolutely necessary, if specifically requested by a client or for other reasons:
- Do not use any filters that contain any PFAS, such as PTFE filters
- Do not use nylon filters.
- Glass filters are recommended to be used.
- Consider use of a centrifuge in the laboratory to reduce the need for sample filtering.

6. Sample Shipment

When prepping samples for shipping:

- Check the cooler periodically to ensure samples are well iced and at the proper temperature.
- Refresh with regular ice, if needed, double bagged in LDPE resealable storage bags if needed.
- Regular ice should be used to cool and maintain the sample at or below the proper temperature.
 - ▲ Chemical or blue ice may be used if it is known to be PFAS-free and it is absolutely certain that the sample is cooled and maintained at or below the proper temperature during collection and through transit to the laboratory.
- Chain of Custody and other forms should be double bagged in LDPE (Ziploc®) storage bags and taped to the inside of the cooler lid.
- The cooler should be taped closed with a custody seal and, if shipping, shipped by overnight courier.
- Samples should be shipped as soon as possible (e.g. overnight) to ensure the samples arrive within the analytical holding time specified by the lab.

Attachment 5

Budget Detail

CLIENT: TVC/NRAC
 PROJECT: PFAS Assessment

ESTIMATE OF PROJECT COSTS

		Task 1 Administration, Reporting, and Health & Safety		Task 2 Surface Water Sampling		Task 3 Soil Sampling		Task 4 Monitoring Well Installation		Task 5 Quarterly Groundwater Sampling		Contingency Task 1 Private Well Assessment		Contingency Task 2 Downgradient Well Installation		
GCES LABOR COSTS																
Personnel		Rate (2020)	Hours	Cost	Hours	Cost	Hours	Cost	Hours	Cost	Hours	Cost	Hours	Cost		
Environmental Services Mgr.	Kevin D. Ringwelski	\$ 165.00 /Hour	7	\$ 1,155.00	0	\$ -	1	\$ 165.00	6	\$ 990.00	4	\$ 660.00	4	\$ 660.00		
Project Geologist/Drilling Manage	Adam R. Biteman	\$ 130.00 /Hour	0	\$ -	0	\$ -	1	\$ 130.00	28	\$ 3,640.00	8	\$ 1,040.00	16	\$ 2,080.00		
Project Manager/Engineer	Adam E. Segerlind	\$ 130.00 /Hour	60	\$ 7,800.00	6	\$ 780.00	6	\$ 780.00	16	\$ 2,080.00	32	\$ 4,160.00	32	\$ 4,160.00		
Sr. Project Scientist	Pete Kallioinen	\$ 105.00 /Hour	4	\$ 420.00	0	\$ -	0	\$ -	0	\$ -	0	\$ -	0	\$ -		
Project Scientist	Michael G. Rankens	\$ 95.00 /Hour	78	\$ 7,410.00	16	\$ 1,520.00	30	\$ 2,850.00	106	\$ 10,070.00	40	\$ 3,800.00	80	\$ 7,600.00		
Environmental Technician	Mark E. Stover	\$ 75.00 /Hour	4	\$ 300.00	0	\$ -	10	\$ 750.00	0	\$ -	128	\$ 9,600.00	0	\$ -		
Environmental Technician	Joshua A. Gerrie	\$ 70.00 /Hour	4	\$ 280.00	12	\$ 840.00	0	\$ -	0	\$ -	128	\$ 8,960.00	0	\$ -		
Driller	Mark Allen	\$ 95.00 /Hour	4	\$ 380.00	0	\$ -	0	\$ -	36	\$ 3,420.00	0	\$ -	0	\$ -		
Driller's Assistant	Ray Favre	\$ 70.00 /Hour	4	\$ 280.00	0	\$ -	0	\$ -	36	\$ 2,520.00	0	\$ -	0	\$ -		
Surveying Department Mgr.	Craig J. Pullen	\$ 165.00 /Hour	0	\$ -	0	\$ -	0	\$ -	21.5	\$ 3,547.50	0	\$ -	0	\$ -		
Project Manager/Survey	Mike P. Stocking, P.S.	\$ 110.00 /Hour	0	\$ -	0	\$ -	0	\$ -	4	\$ 440.00	0	\$ -	0	\$ -		
Senior Survey Crew Chief	Kurt T. Mihatsch	\$ 100.00 /Hour	4	\$ 400.00	0	\$ -	0	\$ -	5	\$ 500.00	0	\$ -	0	\$ -		
Survey Tech./CAD Drafter	Andy D. Baranek	\$ 75.00 /Hour	4	\$ 300.00	0	\$ -	0	\$ -	0	\$ -	0	\$ -	0	\$ -		
CAD Drafter	James R. Lumley	\$ 90.00 /Hour	19	\$ 1,710.00	3	\$ 270.00	5	\$ 450.00	10	\$ 900.00	20	\$ 1,800.00	0	\$ -		
LABOR SUBTOTAL				\$ 20,435.00		\$ 3,140.00		\$ 4,675.00		\$ 28,107.50		\$ 28,220.00		\$ 7,600.00		\$ 20,107.50
GCES DRILLING COSTS																
Drilling costs		\$ 265.00 /hour		\$ -		\$ -	0	\$ -	28	\$ 7,420.00	0	\$ -	0	\$ -	16	\$ 4,240.00
TOTAL GCES DRILLING COSTS				\$0		\$0		\$0		\$7,420		\$0		\$0		\$ 4,240.00
GCES SUBCONTRACTORS																
UPS	Sample Shipment	\$ 150.00 package	0	\$ -	1	\$ 150.00	1	\$ 150.00	2	\$ 300.00	0	\$ -	0	\$ -	2	\$ 300.00
Northern A-1	Soil Disposal	\$ 340.00 drum	0	\$ -	0	\$ -	0	\$ -	32	\$ 10,880.00	0	\$ -	0	\$ -	22	\$ 7,480.00
Northern A-1	Water Disposal	\$ 340.00 drum	0	\$ -	0	\$ -	0	\$ -	16	\$ 5,440.00	0	\$ -	0	\$ -	10	\$ 3,400.00
Northern A-1	Transportation	\$ 2,625.00 Trip	0	\$ -	0	\$ -	0	\$ -	1	\$ 2,625.00	0	\$ -	0	\$ -	1	\$ 2,625.00
Pace	PFAS Water Analytical	\$ 360.00 Each	0	\$ -	8	\$ 2,880.00	3	\$ 1,080.00	13	\$ 4,680.00	108	\$ 38,880.00	45	\$ 16,200.00	10	\$ 3,600.00
Pace	PFAS Soil Analytical	\$ 530.00 Each	0	\$ -	0	\$ -	12	\$ 6,360.00	6	\$ 3,180.00	0	\$ -	0	\$ -	5	\$ 2,650.00
SUBCONTRACTOR SUBTOTAL				\$ -		\$ 3,030.00		\$ 7,590.00		\$ 27,105.00		\$ 38,880.00		\$ 16,200.00		\$ 20,055.00
GCES MATERIALS/REIMBURSEABLES																
		Unit Cost	Qty.	Cost	Qty.	Cost	Qty.	Cost	Qty.	Cost	Qty.	Cost	Qty.	Cost	Qty.	Cost
Rope & Tubing		\$ 0.10 Ft	0	\$ -	50	\$ 5.00	0	\$ -	0	\$ -	0	\$ -	0	\$ -	0	\$ -
Tubing - TYGON (Cole Parmer)		\$ 2.00 Ft	0	\$ -	3	\$ 6.00	0	\$ -	0	\$ -	60	\$ 120.00	0	\$ -	0	\$ -
Water (deionized)		\$ 2.00 Gal	0	\$ -	0	\$ -	1	\$ 2.00	4	\$ 8.00	40	\$ 80.00	8	\$ 16.00	3	\$ 6.00
Nitrile Gloves (Disposable)		\$ 10.00 Box	0	\$ -	1	\$ 10.00	1	\$ 10.00	4	\$ 40.00	8	\$ 80.00	4	\$ 40.00	3	\$ 30.00
Water Level Meter		\$ 15.00 day	0	\$ -	0	\$ -	0	\$ -	4	\$ 60.00	0	\$ -	0	\$ -	3	\$ 45.00
Low-Flow Sample Kit		\$ 125.00 day	0	\$ -	0	\$ -	0	\$ -	0	\$ -	16	\$ 2,000.00	0	\$ -	0	\$ -
Sampling supplies - misc		\$ 10.00 day	0	\$ -	0	\$ -	0	\$ -	0	\$ -	16	\$ 160.00	0	\$ -	0	\$ -
Equipment Truck		\$ 50.00 day	0	\$ -	0	\$ -	0	\$ -	4	\$ 200.00	0	\$ -	0	\$ -	3	\$ 150.00
Hand Auger		\$ 15.00 day	0	\$ -	0	\$ -	1	\$ 15.00	4	\$ 60.00	0	\$ -	0	\$ -	3	\$ 45.00
55-gal Drum		\$ 44.00 day	0	\$ -	0	\$ -	0	\$ -	44	\$ 1,936.00	0	\$ -	0	\$ -	30	\$ 1,320.00
12" x 12" Manhole Cover		\$ 110.00 each	0	\$ -	0	\$ -	0	\$ -	16	\$ 1,760.00	0	\$ -	0	\$ -	5	\$ 550.00
2"x10' FT PVC Riser		\$ 24.00 each	0	\$ -	0	\$ -	0	\$ -	16	\$ 384.00	0	\$ -	0	\$ -	5	\$ 120.00
2" PVC Point		\$ 6.00 each	0	\$ -	0	\$ -	0	\$ -	16	\$ 96.00	0	\$ -	0	\$ -	5	\$ 30.00
2" Morrison Plug		\$ 31.00 each	0	\$ -	0	\$ -	0	\$ -	16	\$ 496.00	0	\$ -	0	\$ -	5	\$ 155.00
Bentonite Chips (50# bag EnviroPlug)		\$ 10.00 each	0	\$ -	0	\$ -	0	\$ -	48	\$ 480.00	0	\$ -	0	\$ -	32	\$ 320.00
Filter Sand (50# bag)		\$ 10.00 each	0	\$ -	0	\$ -	0	\$ -	93	\$ 930.00	0	\$ -	0	\$ -	62	\$ 620.00
2"x5' FT SCH 40 PVC Screen, 10 SLOT		\$ 21.00 each	0	\$ -	0	\$ -	0	\$ -	16	\$ 336.00	0	\$ -	0	\$ -	5	\$ 105.00
Steamer		\$ 50.00 day	0	\$ -	0	\$ -	0	\$ -	4	\$ 200.00	0	\$ -	0	\$ -	3	\$ 150.00
MATERIAL SUBTOTAL				\$ -		\$ 21.00		\$ 27.00		\$ 6,986.00		\$ 2,440.00		\$ 56.00		\$ 3,646.00
TOTAL COST PER TASK				\$ 20,435.00	\$ 6,191.00	\$ 12,292.00	\$ 69,618.50	\$ 69,540.00	\$ 23,856.00	\$ 48,048.50						
										Total		\$ 249,981.00				